Issue 3: Wildlife and Subsistence Use

Issue statement: *The proposed action combined with past timber harvest would affect old-growth habitat and increase road density, which may affect a range of wildlife, including deer and wolves, and subsistence use of deer.*

Public comments expressed concern about wildlife and subsistence in the Big Thorne project area. Concern was noted relative to deer, wolf, goshawk, black bear, marten, and other species. Because of its proximity to residents of Thorne Bay, Coffman Cove, Klawock, Craig, and Naukati, the Big Thorne project area is considered an important deer hunting area for these communities. The cumulative effects on old-growth habitat associated with additional harvest taken together with past harvest, old-growth connectivity, and increasing road density were also noted concerns. Additional concerns are project-related effects to deer as they relate to wolves and subsistence users.

Alternative 4 responds to these concerns by emphasizing landscape connectivity and the protection of key wildlife travel corridors; the minimization of impacts to sensitive plants (see the Botany section for additional discussion) and wildlife species, including wolves, goshawks, black bears, deer, and marten; and the retention of old-growth forest structure. Design features were incorporated into Alternative 4 to minimize effects to wildlife and subsistence (see the Wildlife and Subsistence Resources Report for a unit-by-unit description).

Units of Measure

The comparison of alternatives for this issue focuses on the following units of measure:

- Total, high-volume, and large-tree productive old growth (POG) acres by value comparison unit (VCU), Wildlife Analysis Area (WAA), project area, and biogeographic province;
- Connectivity/fragmentation (qualitative analysis of corridors; reduction of POG acres; patch size analysis);
- Road density in miles per square mile (all roads [open and closed]) by WAA below 1,200 feet and for all elevations for both National Forest System (NFS) lands only and all lands;
- Deer habitat capability by WAA in deer habitat units (based on deer model outputs);
- Deer habitat capability by WAA, Prince of Wales Island, and biogeographic province in deer per square mile (based on deer model outputs);
- Deer deep snow and average snow winter habitat acres harvested by WAA;
- Goshawk habitat (total POG and high-volume POG) acres harvested by VCU and percent of the landscape consisting of POG and mature second-growth by VCU and in the project area;
- Marten deep snow winter habitat acres harvested by WAA;
- Interior forest acres remaining within the project area; and

- Abundance and distribution of, access to, and competition for known subsistence resources.

Regulatory Framework

Shown below is a partial list of Federal laws and executive orders pertaining to project-specific planning and environmental analysis for wildlife and subsistence use on Federal lands. While most pertain to all Federal lands, some are specific to Alaska.

- National Forest Management Act (NFMA) of 1976 (as Amended)
- Multiple Use-Sustained Yield Act
- Endangered Species Act (ESA)
- Marine Mammal Protection Act
- Bald and Golden Eagle Protection Act of 1940 (as Amended)
- Migratory Bird Treaty Act of 1918 (Amended 1936 and 1972)
- Executive Order 13443 (Hunting Heritage and Wildlife Conservation)
- Alaska National Interest Lands Conservation Act (ANILCA)

Wildlife

Section 7 of the ESA directs Federal agencies to ensure that actions authorized, funded or carried out by them are not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitat. Impacts to Federally listed species are addressed in detail in the project Biological Assessment/Biological Evaluation (BA/BE) for wildlife and fish (available in the Big Thorne Project record) and summarized below. The National Marine Fisheries Service (NMFS) provided their concurrence with the BA conclusions regarding ESA-listed species under NMFS jurisdiction in a letter dated June 7, 2013 (see project record).

The National Forest Management Act 1982 planning rule (section 36 CFR 219.19 1982) requires that the Forest Service, through development and implementation of a Forest Plan, manage fish and wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species in the planning area and ensures that its actions do not contribute to trends toward Federal listing. To that end, management indicator species (MIS) were identified in the Forest Planning process. These species are used to evaluate project-related impacts to wildlife; their population changes are believed to indicate the effects of land management activities on other species with similar habitat needs. Likewise, the Forest Service manual directs the Regional Forester to identify sensitive species for each National Forest where species viability may be a concern and requires the Forest Service to manage the habitat of the species listed in the Regional Sensitive Species List (USDA Forest Service 2009d) to prevent further declines in populations, which could lead to Federal listing under the ESA. Impacts to Forest Service sensitive species are also addressed in detail in the project BA/BE for wildlife and summarized in this section.

The Tongass Forest Plan conservation strategy, which consists of a forest-wide system of old-growth reserves (OGRs) and a series of standards and guidelines applicable to lands where timber harvest is permitted (matrix lands), was developed to ensure the maintenance of well-distributed, viable populations of old-growth-associated wildlife species across the Tongass (USDA Forest Service 2008a, 2008b). The OGRs, in combination with other non-development LUDs and standards and guidelines in the matrix, are designed to maintain the integrity of the old-growth ecosystem and provide adequate habitat for old-growth dependent or associated species. Standards and guidelines protect other key wildlife habitats (e.g., riparian areas, the beach fringe, and wetlands); raptor nests sites and wolf dens; and components of the old-growth forest ecosystem (e.g., snags). Collectively, the reserve system and the standards and guidelines are intended to provide old-growth habitat connectivity across the landscape. A detailed overview of the Conservation Strategy is provided under Issue 2.

Subsistence

The U.S. Congress recognized the importance of subsistence resource gathering to the rural communities of Alaska with the passage of ANILCA (Public Law 96-487). ANILCA (Section 803) defines subsistence as: "The customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools or transportation; for the making and selling of handicraft articles out of non-edible by-products of fish and wildlife resources taken for personal or family consumption; and for customary trade."

ANILCA provides for the continuation of the opportunity for subsistence uses by rural residents of Alaska, including both Natives and non-Natives, on Federal public lands. The act also mandates that customary and traditional subsistence uses of renewable resources shall be the priority consumptive uses of all such resources on the public lands of Alaska. Rural residents are provided a preference for the taking of subsistence resources on public lands. Section 810 of ANILCA requires the Forest Service, in determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of NFS lands in Alaska, to evaluate the potential effects on subsistence uses and needs, followed by specific notice and determination procedures should there be a significant possibility of a significant restriction of subsistence uses. Section 811 of ANILCA requires that rural residents engaged in subsistence uses have reasonable access to subsistence resources on public lands. The road system within the Big Thorne project area would continue to provide rural residents with reasonable access for subsistence uses. The EA for the Prince of Wales ATM analyzed access for subsistence use on Prince of Wales Island. The decision for the road management objectives for the existing roads on Prince of Wales Island and surrounding islands was based on this analysis. No changes to this decision on the Prince of Wales ATM are proposed with this project. Access within the project area is also discussed below.

Methodology

Sources of information used in the preparation of this analysis include field reconnaissance, aerial photo interpretation, existing Forest Service GIS data, peer-reviewed literature (cited as appropriate below), previous NEPA analyses in the vicinity of the Big Thorne Project, and information from knowledgeable individuals.

Field Surveys

Forest Service personnel conducted goshawk surveys in the Big Thorne project area in 2010, 2011 2012, and 2013 according to the Tongass National Forest Project-level Goshawk Inventory Protocol, a modified Broadcast Acoustical Survey method adapted for implementation on the Tongass National Forest (Stangl 2009). Additional information on goshawk surveys is provided in the project BA/BE for wildlife. In 2010, black-tailed deer winter habitat was assessed following the protocol described in Quick-Cruise Method for Assessing Deer Winter Range in Southeast Alaska (Kirchhoff and Hanley 1992). Incidental observations of wildlife and sign were made during the field surveys, though these observations do not provide an accurate representation of all wildlife species potentially occurring in the project area due to timing, coverage, and length of surveys. Additional detail on wildlife surveys is provided in the Wildlife and Subsistence Resource Report (Woeck 2013a). Supplemental information on the presence of endemic mammals in the Big Thorne project area was obtained from small mammal trapping conducted in association with the Island Surveys to Locate Endemic Species (ISLES) program (http://www.msb.unm.edu/mammals/ISLES_ website_final_20091028/ isles_home.html).

Analysis Area

The analysis of direct and indirect effects to biodiversity consists of the following scales:

- VCUs coinciding with the project area and the North Central biogeographic province to capture localized effects to biodiversity associated with habitat loss and fragmentation, and
- The North Central Prince of Wales biogeographic province (province 14), which covers the northern and central portions of Prince of Wales Island and some adjacent islands, to facilitate a more comprehensive, broad analysis of biodiversity effects.

For the analysis of cumulative effects on biodiversity, ongoing and reasonably foreseeable projects were drawn from the area encompassed by the North Central Prince of Wales biogeographic province. This area is an appropriate extent because it captures projects with potential effects related to biodiversity which may overlap in space or time with the Big Thorne Project.

The Big Thorne EIS tiers to the analysis of cumulative effects at the Forest scale in the 2008 Forest Plan Final EIS (USDA Forest Service 2008c). This analysis fully considered the levels of past and likely future harvest and associated development on NFS and non-NFS lands, accounting for projects such as Big Thorne. The 2008 Forest Plan Final EIS concluded that with full implementation of the Forest Plan, extensive areas in reserves, distributed across the North Central Prince of Wales biogeographic province, would be maintained through the conservation strategy (USDA Forest Service 2008c). No gaps in the distribution of organisms within the province were anticipated (USDA Forest Service 2008c).

The analysis area for direct and indirect effects to wildlife and subsistence consists of several scales:

§ For species with limited mobility, specific habitat requirements for effective movement, or smaller home ranges (e.g., Prince of Wales spruce grouse and Prince of Wales flying squirrel), impacts were assessed within VCUs coinciding with the project area.

§ For mobile species (i.e., cavity nesting species, the marbled murrelet, and migratory birds which may use the project area for nesting), impacts were assessed at the project area scale.

§ For wider-ranging species such as the black-tailed deer, wolves, marten, and black bears and for subsistence impacts were assessed at the WAA and/or multiple WAA scale (deer at province scale).

For the analysis of cumulative effects, analysis areas or spatial extent considered for most wildlife species and subsistence are the same as those described above for direct and indirect effects because these areas already extend beyond the project-related effects. Thus, they capture the effects of past, present, and reasonably foreseeable projects that may overlap in space and time with the effects of the Big Thorne Project on the same species/resource. The temporal extent considered for cumulative effects to wildlife and subsistence is 10 years (based on the 5-year timber sale plan which identifies future timber sale projects anticipated to occur within the next 5 to 10 years under the current Forest Plan) plus additional time for harvested stands (assuming no reentry) to mature and develop old-growth conditions (approximately 150 years after harvest). Exceptions are the deer, wolves, and goshawks for which cumulative effects were analyzed at the biogeographic province scale. Additionally, the cumulative effects analysis accounts for past, ongoing, and reasonably foreseeable actions on both NFS and non-NFS land ownerships and presents results in terms of the amount of original (1954) habitat remaining. Additional projects considered in this analysis are listed under the Cumulative Effects subheading below.

The Big Thorne EIS tiers to the viability assessments for goshawks, marten, wolves, other terrestrial mammals (well-distributed mammals and endemic mammals), and marbled murrelets; and the analysis of cumulative effects at the Forest scale in the 2008 Forest Plan Final EIS (USDA Forest Service 2008c). These analyses fully considered the levels of past and likely future harvest and associated development on NFS and non-NFS lands, accounting for projects such as Big Thorne. The 2008 Final EIS concluded that full implementation of the Forest Plan (in 100+ years) is expected to have a moderate to very high likelihood of maintaining habitat that supports viable and well-distributed populations of wildlife (USDA Forest Service 2008c).

Analysis Methodology

The direct, indirect, and cumulative effects of the Big Thorne Project on wildlife and subsistence were assessed assuming that the proposed project would be implemented in 2014. In reality, timber sale implementation would be spread out over a number of years up to a 10-year period.

Vegetation Classification and the Size-Density Model

The vegetation of Southeast Alaska and the Tongass National Forest is dominated by temperate coastal rain forests at lower elevations (less than about 2,000 feet), with interspersed muskegs, wetlands, and non-forest vegetation. At higher elevations, alpine vegetation, rock, glaciers, and snowfields dominate. In general, old-growth forest is the ecosystem most affected by timber management activities on the Tongass (USDA Forest Service 2008b). Therefore, the analysis of impacts to biodiversity focuses on the old-growth forest ecosystem.

Old-growth forests on the Tongass can be classified as unproductive and productive. Productive old-growth (POG) is generally defined as old-growth forest capable of producing at least 20 cubic feet of wood fiber per acre per year, or having greater than 8,000 board feet per acre. The size density model (SDM), which uses a combination of tree sizes and tree densities to classify forest structure (Caouette et al. 2006), is used by Forest Service managers and planners to map POG and assess impacts to wildlife and habitats. This classification system builds on the timber volume-based classification system (volume strata) for POG used prior to the 2008 Forest Plan (low, medium, and high-volume), which used only hydric soils and steep slopes as measures productivity and growth. By incorporating the characterization of forest structure, the SDM is more applicable in assessing biodiversity, estimating timber values, and describing wildlife habitat than using timber volume alone. The following seven POG types have been defined which illustrate the crosswalk between the volume strata approach and the SDM (USDA Forest Service 2008b):

- **SD4H:** Volume class 4 on hydric soils. Low productive older forests associated with wet, poorly drained land types. Canopy closure is variable. Trees are small, old, and defective. Stand volume is low.
- **SD4N:** Volume class 4 on non-hydric soils, north aspect, or flat. Low to moderately productive older upland forests. Canopy characteristics are variable and patchy, with moderate canopy closure and relatively coarse canopy texture. Stand volume is low to moderate.
- **SD4S:** Volume Class 4 on non-hydric soils, not north aspect, or flat. Highly productive younger upland forests. Stand volume is moderate, but increasing rapidly. Crown competition is high. Canopy characteristics tend to be uniform, with high canopy closure and fine canopy texture.
- **SD5H:** Volume class 5 on hydric soils. Moderately productive older forests associated with wet, poorly drained land types. Canopy closure, texture, and structure tend to be variable and patchy. Stand volume and annual growth is also variable and patchy.
- **SD5N:** Volume class 5 on non-hydric soils, north aspect, or flat. Moderately productive older upland forests. Stand volume is moderate to high. Canopy characteristics tend to be variable, with moderate canopy closure and coarse canopy texture.

- **SD5S:** Volume class 5 on non-hydric soils, not north aspect, or flat. Highly productive upland forests. Stand volume is high. Canopy characteristics tend to be uniform, with moderate to high canopy closures.
- **SD67:** Volume classes 6 and 7. Highly productive forests associated with riparian areas, alluvial fans, colluvial toe slopes, karst geology, and wind-protected uplands. Stand volume is high. Stand age can vary. Canopy closure is low to moderate and canopy texture is coarse.

POG is defined further in terms of two categories. High-volume POG is defined as the grouping of the three SD Model types that represent the highest volume stratum—SD5S, SD5N, and SD67 types. Large-tree POG is defined as the SD67 type, representing the most productive of the POG types, and typically containing the highest density of large trees. The 2008 Forest Plan Final EIS provides more information on the development and use of the Size Density Model (USDA Forest Service 2008c).

Deer, Wolf, and Subsistence Analyses

Forest Plan standards and guidelines require the use of the most recent version of the interagency deer habitat capability model to assess impacts to deer habitat (WILD4.XIV.A.2; USDA Forest Service 2008a). The deer model takes into account snow depth (indicative of typical, moderate winter severity), elevation, aspect, and conifer forest successional stage to provide a habitat suitability index (HSI) of habitat capability. High model scores represent features that are correlated with high value deer habitat. These features include closed canopy (based on volume class rather than canopy cover), low elevation south facing slopes, and low average snow depth. Habitat capability values are used in this analysis to estimate changes that result from timber harvest, but do not reflect actual deer numbers.

To compare alternatives, changes in habitat capability are presented in terms of units (deer habitat capability units or deer per square mile) and as a percent. Results from this modeling exercise are also used to evaluate impacts to wolves and subsistence resources. The Forest Service recently issued direction on the use of the deer model including required analyses and model assumptions for wolves and subsistence (USDA Forest Service 2011b). Model assumptions and shortcomings for deer, wolves, and subsistence resources are described below under the appropriate subheading.

Cumulative Effects

For the cumulative effects analysis, foreseeable timber harvest projects with known locations were incorporated into the GIS layer (see Chapter 3 introduction for additional detail). Other projects that are dependent on funding, and for which timing and location are unknown, are discussed qualitatively. Young-growth treatments and restoration projects that involve pre-commercial thinning are also discussed qualitatively because the stem exclusion stage is based on age which is unchanged by thinning treatments and because the deer model does not assign different values as a result of these stand treatments.

In addition to the cumulative effects projects identified in the project area, the wildlife and subsistence analysis also takes into consideration additional activities within the project area WAAs, located outside the project area boundary. These include additional state harvest and road construction. For the biogeographic province level cumulative effects analysis for wolves, present and reasonably foreseeable projects include additional state harvest and NFS harvest within the province (see the beginning of this chapter and Appendix D).

Affected Environment

Biodiversity

Biodiversity may be defined as "the variety of life forms and processes, including the complexity of species, communities, gene pools, and ecological functions, within the area covered by a land management plan" (USDA Forest Service 2008a). Biological diversity encompasses the variety of genetic stocks, plant and animal species and subspecies, ecosystems, and the ecological processes through which individual organisms interact with one another and their environments. Under the National Forest Management Act (NFMA), the Tongass National Forest must provide for diversity of plant and animal communities based on the suitability and capability of specific land areas.

Old-Growth Habitat

Old-growth forests support high levels of biodiversity due to their structural and ecological complexity. In Southeast Alaska, old-growth forests are typically greater than 150 years old, and are characterized by complex canopies; an interspersion of trees of multiple age classes; the presence of snags, decadent trees, and fallen trees; and variation in the amounts and distribution of live trees. These features create intricate habitat niches that support many plant and animal species (Spies 2004). In Southeast Alaska, old-growth forests have been the focus of past timber harvest.

The North Central Prince of Wales Island biogeographic province historically contained more POG than any other biogeographic province on the Tongass (Forest Plan 2008b). It has also experienced the highest amount of harvest relative to other biogeographic provinces, with 70 percent of the total original (1954) POG on all ownerships remaining, ranging from 40 to 100 percent by VCU (Table WLD-1). There are approximately 569,005 acres of POG currently within the North Central Prince of Wales biogeographic province (Table WLD-1). Existing POG by WAA is discussed in the Black Bear and other subsections.

Low elevation, larger-tree stands have been disproportionately harvested on the Tongass because these highly productive and economical sites (i.e., those easiest to access) were targeted in the early years of commercial timber harvest (USDA Forest Service 2008b). Within the North Central Prince of Wales biogeographic province, approximately 62 percent of the original high-volume POG (ranging from 18 to 100 percent by VCU) and 63 percent of the original large-tree POG (ranging from 13 to 100 percent by VCU) on all ownerships remain (Table WLD-1). The North Central Prince of Wales biogeographic province currently includes over 10 and 20 percent of all the remaining high-volume and large-tree POG on the Tongass, respectively (USDA Forest Service 2008b).

An intact, undeveloped landscape is assumed to be fully functional, maintaining focal species, communities, and/or systems and their supporting ecological processes within their natural ranges of variability (Poiani et al. 2000). Thus, the intactness of a landscape is another measure of the degree to which biodiversity has been affected by human actions. Based on the definition of an intact landscape used in the 2008 Forest Plan Final EIS, (a VCU with at least 95 percent of the original POG remaining), three project area VCUs (5750, 5820, and 5960) are intact, and thus likely to maintain a high degree of biodiversity. Although landscapes with higher amounts of past harvest likely remain fully functional, this threshold represents an index used to identify areas that are in relatively pristine conditions and thus have the highest biological importance.

Table WLD-1. Existing Total, High-Volume, and Large-Tree POG by Biogeographic Province, VCU, and Project Area

Biogeographic Province/VCU[1/]	All POG (acres)	% Original POG Remaining	High Volume POG (acres)	% High Volume POG Remaining	Large Tree POG (acres)	% Large Tree POG Remaining
North Central Prince of Wales Island	569,005	70	248,324	62	127,295	63
5720[2/]	3,869	51	1,149	33	824	40
5740	14,953	80	5,503	70	3,155	75
5750	11,141	97	4,551	95	2,237	95
5760	6,984	93	3,338	91	1,630	91
5780	3,688	75	2,205	73	1,640	82
5790[2/]	2,813	40	934	25	334	21
5800	7,036	72	3,579	67	1,385	64
5810[2/]	6,809	50	3,790	47	1,732	47
5820	2,461	100	1,348	100	963	100
5830[2/]	4,866	57	2,115	47	884	45
5840[2/]	5,826	59	1,944	42	557	32
5850[2/]	3,088	41	635	18	190	13
5860[2/]	6,323	45	3,418	41	1,410	35
5950[3/]	7,051	59	3,546	53	2,566	61
5960	5,590	97	2,592	95	1,499	96
5971	1,516	83	987	84	751	90
5972[2/]	8,584	66	3,441	54	1,257	49
5980[3/]	5,459	58	2,640	52	1,572	57
Project Area	98,654	67	43,867	58	22,116	60

1/ Includes NFS and non-NFS lands; accounts for entire VCU, including areas extending outside of the project area boundary (includes VCUs within the project area where no timber harvest is proposed)
2/VCUs where the Legacy standard and guideline applies.
3/The Legacy standard and guideline does not currently apply to VCU 5980 or VCU 5950 because less than 33 percent of the original POG had been harvested in 2005 when the analyses for the 2008 Forest Plan FEIS were calculated, and less than 67 percent of the total POG is projected to be harvested by the end of the Forest Plan planning horizon.

The likelihood of a population persisting over time has been suggested to be related to some threshold level of habitat loss on the landscape (Fahrig 1997, 1999, 2003; Flather et al. 2002; Andren 1994). After reaching this threshold, the rate of population decline, and thus the likelihood of extinction, may increase (Haufler 2006). Reported threshold levels (percentage of habitat maintained on the landscape) range from 20 percent (Fahrig 1997) to 50 percent (Soule and Sanjayan 1998), depending in part on the dispersal capability of the species under consideration. That is, the extent of fragmentation or connectedness is not inherent but must be assessed in the context of an organism's ability to move between patches and the scale at which the organism interacts with the landscape (With 1999 as cited in D'eon et al. 2002). For example, species with limited dispersal capabilities (i.e., flying squirrel) appear to be more sensitive to habitat loss and fragmentation than species with greater dispersal capabilities (i.e., goshawks; D'eon et al. 2002). Natural fragmentation of habitats can also affect the level of additional fragmentation that can be supported. The Forest Plan Legacy Forest Structure standard and guideline is intended to ensure that sufficient residual trees remain in timber harvest units within VCUs that have "experienced concentrated past harvest and are at risk for not providing the full range of matrix functions" (USDA Forest Service 2008a). The Legacy standard applies to VCUs where 33 percent or more of original (1954) total POG has been harvested (67 percent total POG remaining), or where more than 67 percent of the total POG is projected to be harvested by the end of the Forest Plan planning horizon. Currently 8 project area VCUs maintain at least 67 percent of their total original POG or had less than 33 percent harvested (VCUs 5740, 5750, 5760, 5780, 5800, 5820, 5960, and 5971; Table WLD-1). The Legacy standard and guideline applies to the remaining VCUs as identified in the Forest Plan where past harvest (from 1954 to 2005) has reduced the amount of original total POG by more than 33 percent, or where less than 33 percent had been harvested during this period but more than 67 percent is projected to be harvested by the end of the Forest Plan planning horizon (Table WLD-1). The Legacy standard and guideline was applied, where required (i.e., in VCUs identified in the Forest Plan), under all alternatives.

Old-growth forest in the project area has been modified over time by both natural processes and human actions. There are approximately 50,261 acres of young-growth within the project area, of which 49,594 acres are a result of timber harvest. The remaining acres of young-growth are a result of natural processes (e.g., wind). Approximately 19,227 acres (39 percent) of young-growth in previously harvested stands are 25 years old or younger, in the stand initiation stage; the remaining 30,368 acres are older and are in the stem exclusion stage. Management of young-growth stands through pre-commercial and commercial thinning has the potential to increase biodiversity by concentrating growth in fewer, larger trees which, if allowed to grow over time, promote conditions that mimic old-growth stand characteristics at a faster rate than would occur without treatment (USDA Forest Service 2000; Carey 2003). Thinning also opens the understory and increases the amount of understory forage available for a variety of wildlife species. Approximately 12,789 acres of young growth within the project area (25 percent) have been pre-commercially thinned.

Landscape Connectivity

Landscape connectivity is defined as the degree to which the structure of a landscape helps or hinders the movement of wildlife species (Taylor et al. 1993). A landscape with a high degree of connectivity is one in which wildlife move readily between habitat patches over the long term (USDA Forest Service 2008a). On the Tongass, connectivity between areas of similar habitats (i.e., old-growth forest) or between high and low elevation habitats is important to maintaining well-distributed, viable wildlife populations.

Landscape connectivity can be both structurally and functionally based. Structural connectivity refers to the physical connections between areas of habitat that facilitate movement of wildlife. For example, intact stream buffers function as corridors providing structural connectivity between habitat patches. Within the project area the Recreational River LUD surrounding the Thorne River contributes to functioning of the Honker large

OGR complex. Likewise, the beach fringe may provide low elevation structural connectivity between watersheds and function as a transition zone between interior forest and saltwater influences (Julin 1997). Functional connectivity refers to the degree of movement or flow of organisms through broader linkage “zones” which contain an appropriate juxtaposition of habitats and land uses that facilitate movement across the landscape. On the Tongass, matrix lands provide a limited degree of functional connectivity between OGRs and other non-development LUDs.

Fragmentation resulting from actions, both natural and human-caused, reduces landscape connectivity due to the breaking apart of larger contiguous blocks of habitat into smaller patches. The value of residual habitat patches may decline if they become too small to support species with minimum area requirements or to support a subpopulation of a particular organism (i.e., the functional unit of a metapopulation, or population made up of spatially separated local populations that interact with each other). In the latter case, interaction occurs via dispersal as individuals move among patches. Populations may become isolated, and therefore at greater risk of local extirpation, if fragmentation hinders movement of individuals between subpopulations (Wilcove et al. 1986). The degree to which this occurs depends on species-specific dispersal capabilities, the distance between habitat patches, and conditions within the matrix between habitat patches.

When fragmentation occurs there is an increase in the amount of forest edge habitat and a decrease in the amount of interior forest habitat. Fragmentation is often accompanied by a decline in native biodiversity because ecological changes along the habitat edge (edge effects) favor some species over others. Edge effects may include changes in vegetation structure, species composition (both plants and animals), predation rates, and disturbance (Murcia 1995; Nilson et al. 1995; Aas 1999). Although the number of species may be higher along edges (favoring invasive species), the number of habitat specialists (i.e., those associated with interior forest conditions or structural components of old-growth forest), which tend to be more sensitive or at-risk, decreases (Aas 1999; Nilson et al. 1995; Kissling and Garton 2007).

The extent or “depth” of edge effects varies with the contrast in the structure and composition of adjacent vegetative communities, the width of the habitat fragment, and the stability of the remaining vegetation (i.e., as it relates to other environmental effects such as windthrow), and may be species-dependent (Harper et al. 2005; Euskirchen et al. 2006). Edge effects related to vegetation structure and composition typically occur within 165 feet (50 meters) of created forest edges (Harper et al. 2005), whereas edge effects related to habitat functionality for wildlife extend farther (i.e., up to 1,640 feet [500 meters] for edge-related nest predation in migratory songbirds; Wilcove 1987). However, uncertainties remain regarding the spatial and temporal nature of edge effects. Edges are a dynamic component of the landscape. On harvested landscapes, edge contrast may decrease over time with the regeneration of disturbed areas, a process called “edge softening” (Matlack 1994; Euskirchen et al. 2006). Additionally, recent studies suggest that the presence of multiple edges (i.e., three or more adjacent patch types) may affect the magnitude and extent of edge effects (Euskirchen et al. 2006; Li et al. 2007).

Table WLD-2 shows the existing number of POG patches by size class in the project area (i.e., including all POG patches which intersect the project area, resulting in an irregularly shaped area with some patches extending beyond the project area boundary). This includes the inherent level of landscape fragmentation on the Tongass due to the creation of patches through natural processes (e.g., windthrow) and naturally patchy distribution of POG forest interspersed muskeg, forested wetlands, and alpine areas. The patch size classes presented in Table WLD-2 represent fragmentation at multiple scales. Patches at the sub-stand and stand levels (i.e., the smallest size classes) represent scales of influence important to organisms such as lichens, fungi, plants, invertebrates, and small bodied mammals which may be locally endemic; occur in very specific forest structure or soil conditions; or have limited dispersal capabilities. Larger patches represent scales of influence important to wider-ranging species such as deer, marten, and forest-dwelling birds of prey.

Table WLD-2. Number of POG Patches and Acreages by Size Class Intersecting the Big Thorne Project Area under Existing Conditions

Patch Size (acres)	Number of Patches[1/]	Acreage in Size Class
0-25	308	3,039
26-100	96	4,726
101-500	35	7,178
500-1000	7	4,812
1000+	8	82,604
Total	**454**	**102,359**

1/ Includes NFS and non-NFS lands; includes all patches intersecting the project area, some of which extend beyond the project area boundary resulting in a greater total acreage than reported in Table WLD-1.

Corridors

Corridors may be structural (i.e., a physically connected patches of old-growth forest) or functional (i.e., non-contiguous patches of old-growth forest and other vegetation with structural characteristics that continue to facilitate the movement of organisms across the landscape). In the Big Thorne project area, corridors along streams and between old-growth habitats at different elevations have been reduced by past harvest. During public scoping and based on local knowledge of the project area, the following areas were identified as having experienced past harvest and where future alterations could reduce natural connectivity and limit the ability of land-based species to disperse or migrate (Figure WLD-1). (Note that these areas are identified in Figure WLD-1 as “probable” movement corridors, and were identified based on characteristics listed in wildlife standard and guideline WILD1.VI.A.2 Landscape Connectivity [USDA Forest Service 2008a] including a visual assessment of remaining blocks of POG on the landscape.)

- **Honker Divide.** A key part of the old-growth conservation strategy for the northern portion of Prince of Wales Island, consisting of over 200,000 acres (USDA Forest Service 2008c); provides connectivity between old-growth habitat in the Sarkar Lakes area to the north (outside of the project area), the Thorne River drainage to saltwater (and roadless area) to the east, and the Karta Wilderness to the south. The Honker Divide area includes a number of individual corridors:
  - The Cutthroat drainage (VCU 5760) provides north-south connectivity and is located within the Honker large OGR.

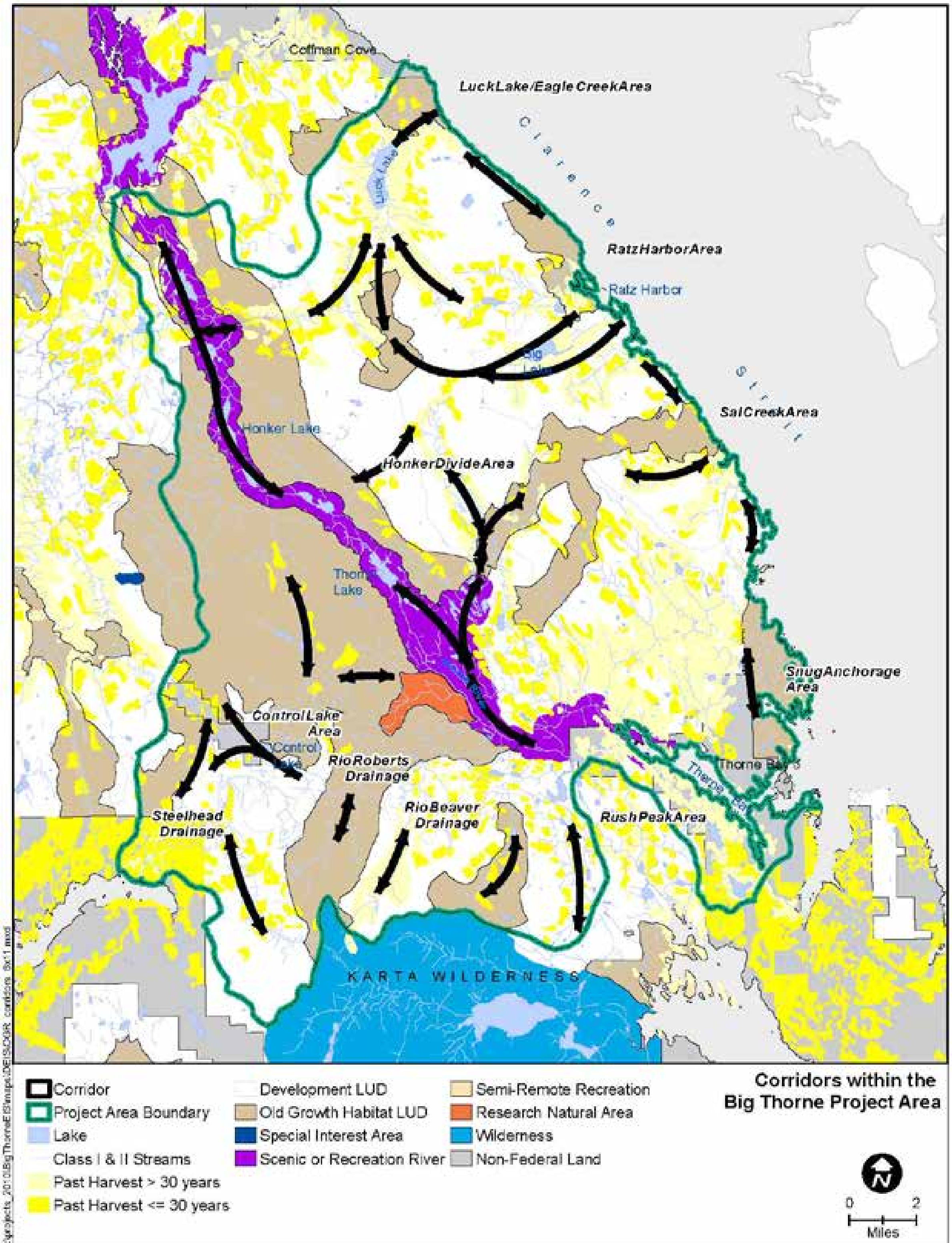

Figure WLD-1. Probable Wildlife Movement Corridors within the Big Thorne Project Area

- The Control Creek drainage (VCU 5760) provides east-west connectivity between the Control Lake area and the Thorne River drainage.
- The North Thorne drainage (VCU 5800) extends from inside the Honker large OGR, branching east and west at its north end. The east branch is within the small OGR.
- A tributary to the Thorne River (VCU 5750; northeast of Thorne Lake) provides north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage.

§ **Rio Beaver Drainage.** One of the primary north-south linkages between the Honker large OGR and the Karta Wilderness (VCU 597.2).

§ **Rio Roberts Drainage**. One of the primary north-south linkages between the Honker large OGR and the Karta Wilderness; located within the Honker large OGR (VCU 5960).

§ **Upper Steelhead Drainage.** Provides north-south connectivity between a portion of the Karta Roadless Area that abuts the Karta Wilderness to the south and another portion of the Karta Roadless Area, which abuts the Honker large OGR to the north (VCU 5950). A branch of the Steelhead also connects the Honker large OGR with Big Salt Lake outside of the project area.

§ **Rush Peak Area.** Provides north-south connectivity between the Honker large OGR and saltwater at Salt Chuck (VCU 5972). Two important corridors in this area are the Rush Creek and Goose Creek drainages, located to the west and east of Rush Peak, respectively.

§ **Control Lake Area.** Functions as a junction of corridors, providing connectivity between the Honker large OGR and the Upper Steelhead, Rio Roberts, and Control Creek drainages (VCUs 5940, 5950, and 5960). Corridor between Control Lake and Honker large OGR has been identified as being important to wolf movement.

§ **Ratz Harbor Area.** Old growth in the vicinity of Ratz Harbor provides east-west connections north and south of Big Lake between the shoreline and interior old-growth forest (VCUs 5810, 5830, and 5840).

§ **Clarence Straight Shoreline.** Old-growth forest along the shoreline, including areas beyond the beach buffer, provides connectivity (though not continuous) between Sandy Beach and Eagle Creek (VCUs 5820, 5830, 5840, and 5850).

§ **Snug Anchorage Area.** Old-growth in the vicinity of Snug Anchorage provides a north-south connection between Sandy Beach/Slide Creek and Thorne Bay (VCUs 5850 and 5880). West of Foss Cove, the corridor is very narrow.

§ **Sal Creek Area.** Old growth in the vicinity of Sal Creek provides connectivity between the saltwater and the North Thorne drainage to the west.

§ **Luck Lake/Eagle Creek Area.** Low-elevation old growth along the riparian corridor of Eagle Creek provides east-west connectivity to saltwater (VCU 5810). Extending from the south end of Luck Lake, corridors also run east-west along Luck Creek to the Honker large OGR (VCUs 5740 and 5810) and north-south along tributaries to Luck Creek to the small OGR in VCU 5810 and to Little Lake.

Management Indicator Species

Management Indicator Species (MIS) are species whose response to land management activities can be used to predict the likely response of other species with similar habitat requirements (Forest Service Manual [FSM] 2631.3). In accordance with the 1982 Planning Regulations, 13 wildlife species were identified as MIS in the Forest Plan (USDA Forest Service 2008a). Of these, three wildlife species (brown bear, mountain goat, and red squirrel) do not occur in the project area and will not be discussed here. The bald eagle and river otter are not addressed in detail in the EIS because they inhabit beach, estuary, and riparian habitats that are maintained under the Forest Plan conservation strategy. Moreover, the project would have negligible effects to these species due to the implementation of best management practices or other avoidance and minimizations measures (see the Wildlife and Subsistence Resource Report for a discussion of these species). Rationale for the selection of the other MIS is provided below. All of the wildlife MIS are associated with POG forests of Southeast Alaska.

Sitka Black-tailed Deer

The Sitka black-tailed deer was selected as an MIS species because it is an important game and subsistence species in Southeast Alaska. They are also an important prey species for Alexander Archipelago wolves and black bears on Prince of Wales Island. Deer population trend information for GMU 2 is variable, and may differ with survey technique, sampling location, and scale of analysis. Deer pellet-group survey data, which are currently used by ADF&G to assess deer population trends throughout Southeast Alaska, indicated that following the winter of 2010 pellet-group counts in GMU 2 as a whole remained stable to increasing, despite three above average winters during 2006 to 2009 (McCoy 2010). In contrast, over approximately the same period (2006-2008) a more accurate DNA-based technique for estimating deer abundance was tested in three intensively harvested sites in north-central Prince of Wales Island (Maybeso Creek, upper Staney Creek, and upper Steelhead Creek; Brinkman et al. 2011). Results of this study identified a 30 percent decline in abundance (all three sites combined) over the study period. ADF&G managers believe, based on field observations of deer browse levels, that populations going into the winter of 2011-2012 were at or beyond carrying capacity in much of the deer winter range in the project area (B. Logan, USDA Forest Service, personal comm. 2012); however, due to high deer mortality rates resulting from the moderately severe winter of 2011-2012, ADF&G expects to see a decline in the deer population within GMU 2 (Person and Gilbert, personal comm. with B. Logan, USDA Forest Service, 2012). Moreover, an ongoing ADF&G fawn mortality study documented a mortality rate of almost 80 percent after the winter of 2011-2012 (Baichtal 2012). In light of the Pacific Decadal Oscillation, continued loss of deer winter habitat, and current observed over-browsing of deer winter range, ADF&G expects a reduction in deer carrying capacity over the next decade (Baichtal 2012).

Research conducted in Southeast Alaska and elsewhere in the Pacific Northwest indicates that low-elevation, high-volume old-growth habitats are particularly important to deer, especially during severe winters (Hanley and Rose 1987; Schoen and Kirchhoff 1990; Yeo and Peek 1992; B.C. Ministry of Forests 1996c). These old-growth stands intercept snow, provide thermal cover, and support the largest biomass of herb and shrub forage for deer (Alaback 1982; Schoen et al. 1984). However, patterns of habitat use may differ between migratory and resident deer. Migratory deer may make more marked shifts between use of higher elevation habitats in summer and lower elevations habitats during winter, whereas resident deer may use low-elevation habitats year-round (B.C. Ministry of Forests 1996a, 1998).

The interagency deer habitat capability model was used to assess existing habitat capability in the WAAs coinciding with the project area. The deer model assumes a linear relationship between habitat capability and habitat values. The current deer model does not take into account juxtaposition of habitats and only accounts for average winters. Shortcomings of the model are described in detail in the 2008 Forest Plan Final EIS (pp. 3-231 and 3-232; USDA Forest Service 2008c). Model assumptions, based on recent direction provided by the Forest Service, include the following:

- Historic conditions were defined as the conditions that existed prior to the onset of large-scale logging in 1954. Historic conditions were reconstructed by converting the 1986 vegetation mapping (TIM86) to the Size Density Model (SDM) types and then converting the areas mapped as harvested prior to that date into the different volstrata and SD67 POG, based on the proportion of these categories in areas harvested prior to 1992.
- All proposed harvest units are treated as even-aged harvest. This is conservative because uneven-aged and two-aged harvest units would retain some of their value to deer.
- Commercial thinning was addressed in the model by leaving stands in the stem exclusion stage after thinning because the stem exclusion stage is based on age which is unchanged by thinning treatments and because the deer model does not assign different values as a result of these stand treatments.
- Stem exclusion was considered 25 years post-harvest (stands 26 to 150 years of age).
- Values output by the model were standardized to range from 0 to 1.0 by dividing all values by 1.3.
- 100 deer per square mile was used as the multiplier.
- Only NFS lands were in the project-related effects (direct and indirect effects) analysis. All land ownerships (NFS and non-NFS lands) were included in the cumulative effects analysis; however, non-NFS lands were given a zero value (conservatively assuming harvest of all non-NFS lands).
- All elevations are included in the analysis, but the model gives acres above 1,500 feet a zero value.
- Model runs assumed 2013 as the current year, 2014 for project implementation, and 2040 for stem exclusion.
- Lakes and lake islands were excluded from the analysis.
- Entire land areas for WAAs where project activities are proposed (WAAs 1315, 1318, 1319, and 1420) were included in the direct and indirect effects analysis (see the Wildlife and Subsistence resource report for the square mile values); WAAs

1316, 1421, and 1422 coincide with the project area, but because no actions are proposed within them they not included in the direct and indirect effects analysis.

§ At the biogeographic province scale (cumulative effects analysis for wolves), the entire land area of WAAs intersecting the biogeographic province was included even though some WAAs extended beyond the province boundary (an exception was WAA 1003 because all the acres within the province were saltwater).

§ No predation was included.

Historic (1954) and current (2013) deer habitat capability is presented in Table WLD-3. Current habitat capability in the WAAs where timber harvest is proposed ranges from 55 to 92 percent of that existing in 1954 (Table WLD-3).

Table WLD-3. Existing Deer Winter Habitat Capability on NFS Lands by WAA

WAA	1954 Deer Habitat Capability[1/]	2013 Deer Habitat Capability [1/]	% of original
1315	2,403	1,418	59%
1318	1,271	1,175	92%
1319	3,325	2,541	76%
1420	1,392	765	55%
Total	**8,391**	**5,899**	**70%**

1/ Deer habitat capability, in deer habitat units (the theoretical number of deer an area could support), calculated from the deer model for winter habitat. Habitat Suitability Indices were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest was treated as even-aged; no predation was included.
Note: WAAs 1316, 1421, and 1422 are slightly within the project area boundary, but no actions are proposed within them.
Source: GIS Database, deer_model.aml

Random events such as snow and other weather conditions can influence the ecology and behavior of wintering deer by decreasing forage availability and increasing the amount of energy it takes to move through the forest (Hanley et al. 1986; B.C. Ministry of Forests 1996b; Farmer et al. 2006; White et al. 2009). During a winter with average snowfall, more habitat is available at higher elevations than during years with more severe winters. Thus, the habitats available to deer, depending on winter severity, can be defined as:

§ Average snow winter habitat is defined as all POG below 1,500 feet elevation, and

§ Deep snow winter habitat is defined as high-volume POG below 800 feet elevation, representing the shift toward use of lower elevations and more dense stands of POG during severe winters.

Average snow winter habitat has been reduced by 25 to 56 percent and deep snow winter habitat has been reduced by 35 to 69 percent from original (1954) amounts, depending on the WAA (Table WLD-4).

Spring, summer, and fall habitats (non-winter) are also important for deer reproduction and population recovery following severe winters, and for building up pre-winter body reserves. These habitats include all vegetation types, except young-growth in the stem exclusion phase. Since 1954, non-winter habitat has been reduced by 14 to 32 percent, depending on the WAA (Table WLD-4).

Although deer in Southeast Alaska are considered an old-growth species, they will forage in early seral stands in mild winters, spring, and summer. During the first 25 years (stand initiation), openings created by timber harvest provide abundant forage for deer as sunlight is allowed to penetrate to the forest floor enhancing growth of understory vegetation (Farmer and Kirchhoff 2007). However, as the forest regenerates, a dense canopy can form that shades out understory vegetation (stem exclusion) thereby reducing foraging habitat—a period which may last up to 150 years after harvest. Deer abundance has been shown to be lower in these forage-poor habitats (Brinkman 2009; Person et al. 2010). Thus, the effects of timber harvest are not fully realized until decades after.

Table WLD-4. Existing Average Snow Winter Habitat, Deep Snow Winter Habitat, and Non-Winter Habitat on NFS and Non-NFS Lands by WAA

WAA	Habitat	Original (1954) Acres	2012 Acres	% Change	% of Total WAA Area with Available Habitat under Existing Conditions
1315	Deep Snow[1/]	24,383	9,293	-63%	6%
	Average Snow [2/]	56,662	26,500	-53%	17%
	Non-Winter[3/]	96,780	66,004	-32%	43%
1318	Deep Snow[1/]	22,243	7,600	-66%	5%
	Average Snow [2/]	57,396	25,339	-56%	17%
	Non-Winter[3/]	123,442	89,474	-28%	62%
1319	Deep Snow[1/]	18,092	11,820	-35%	11%
	Average Snow [2/]	54,950	41,042	-25%	39%
	Non-Winter[3/]	102,637	88,400	-14%	85%
1420	Deep Snow[1/]	10,075	3,166	-69%	5%
	Average Snow [2/]	29,205	15,212	-48%	24%
	Non-Winter[3/]	46,187	31,988	-31%	51%

1/ High-volume POG (SD 5S, 5N, 67) at or below 800 feet elevation
2/ All POG (SD 4H, 4N, 4S, 5H, 5S, 5N, 67) at or below 1,500 feet elevation
3/ Spring/summer/fall habitat; all POG, non-productive old-growth and non-forested muskeg, alpine habitats

Alexander Archipelago Wolf

The Alexander Archipelago wolf was selected as an MIS because it is a species of concern and an important furbearer. The Alexander Archipelago wolf is a subspecies of gray wolf endemic to Southeast Alaska that inhabits the mainland and islands south of Frederick Sound. Wolves inhabiting Prince of Wales Island are genetically isolated from other populations in Southeast Alaska (Person 2001; Weckworth et al. 2005, 2010, 2011). Monitoring populations of wolves in the temperate rainforests of Southeast Alaska is challenging because thick forest cover makes detecting and observing wolves very difficult. Current estimates of the wolf population in GMU 2 are lacking; however, approximately 250-350 wolves were estimated to inhabit Prince of Wales Island and the surrounding islands (Person et al. 1996). However, the population on Prince of Wales Island may be lower than in previous years based on the lack of scats observed during 2009 and 2010 field effort (e.g., 30-35 scats collected versus 154 collected during a 1993-1994 effort; Person 2010, Kohira 1995). That observation was consistent with testimony from local trappers during the 2010 Alaska Board of Game meeting in Ketchikan (B. Logan, USDA Forest Service, personal comm. 2012). At this meeting, ADF&G reported that anecdotal observations by state and Federal biologists, trappers, and hunting outfitters/guides suggested the wolf population had declined to as few as 150 wolves in

GMU 2. The Tongass National Forest is currently partnering with ADF&G to establish protocols for estimating and monitoring wolf population status and trends in GMU2.

In August 2011, the USFWS received a petition to list the subspecies as threatened or endangered, and to recognize Prince of Wales Island as a significant portion of its range (Center for Biological Diversity and Greenpeace 2011). The petition also requested that the USFWS consider Prince of Wales Island and adjacent islands (including Kosciusko, Tuxekan, Heceta, Suemez, Dall, and others proximate to Prince of Wales) a Distinct Population Segment based on unique genetic, physical, and ecological characteristics. At the time of this writing, the USFWS is currently conducting a 90-day review of the Alexander Archipelago wolf ESA petition which will conclude with the determination of whether or not the petition should be moved forward for additional review.

Wolves in Southeast Alaska use a wide variety of habitats but spend most of their time in productive and unproductive old-growth forests at low elevations (below 270 feet [82 meters]; young seral forests and clearcuts are typically avoided (Person 2001). Dens on Prince of Wales Island are located in root wads of large living or dead trees within old-growth forest stands less than 495 feet (150 meters) from freshwater (Person and Russell 2009). In GMU 2, wolves feed primarily on deer, though they will feed on beaver and spawning salmon when available (Darimont et al. 2002; Szepanski et al. 1999). Deer winter habitat was considered by Person (2001) to be a good measure of habitat quality for wolves in southern Southeast Alaska. Conserving winter habitat is important for maintaining the resilience of deer to severe winter weather, predation by wolves and black bears, and hunter harvest (Person et al. 1996; Person 2001). Forest Plan standards and guidelines require, where possible, the provision of sufficient deer habitat capability to first maintain sustainable wolf populations, and then to consider meeting estimated human deer harvest demands. This is generally considered to equate to the habitat capability to support a minimum of 18 deer per square mile (using habitat capability model outputs; USDA Forest Service 2008a). However, other factors (e.g., local knowledge of habitat conditions) are to be considered by the biologist, as well, rather than solely relying upon model outputs.

Prior to the start of large-scale commercial timber harvest in 1954, habitat capability in WAAs 1315 (28.3 deer per square mile), 1319 (20.9 deer per square mile), and 1420 (21.5 deer per square mile) exceeded this level where as WAA 1318 (14.7 deer per square mile) did not; currently, none of the project area WAAs supports 18 deer per square mile (Table WLD-5). This suggests that, based on modeled deer densities alone, the project area WAAs may not be capable of sustaining wolves without immigration from neighboring areas (see the Deer subsection above for information on deer population trends within GMU 2). However, this does not take into account the fact that wolves are highly mobile and move between WAAs and thus wolf packs may be supported by a number of adjacent WAAs (Person and Logan 2012); the potential benefits of young-growth management for deer habitat and road management for controlling hunter access; or the presence of the Honker Divide Large OGR complex (200,000+ acres) and the Karta Wilderness (about 40,000 acres) both adjacent to the project area. For example, wolves occupying the Honker Divide OGR also use areas of North and East Thorne River that are within the project area (Person 2001).

Harvesting of wolves is regulated by the Federal Subsistence Board and the State of Alaska Board of Game (see the Wildlife and Subsistence Resource Report for harvest regulations). Legal harvest may annually remove up to 25–30 percent of the estimated wolf population and is considered to be the primary source of wolf mortality on Prince of Wales Island; however, this estimate does not include illegal take, which has been estimated to be as much as 46 percent of wolf mortality (Person and Russell 2008). From a biological perspective, in order to maintain the current population, the level of harvest-related mortality should not exceed 38 percent (Person and Russell 2008). A 30 percent cap (of the fall population) on wolf harvest in GMU 2 was designed by ADF&G to prevent serious declines in the wolf population. The ADF&G and Forest Service can put in effect the emergency closure on wolf harvest if the sealing data indicate that the 30 percent harvest cap has been reached or exceeded. However, there is some debate as to whether or not the harvest cap should be based on the lower population estimate of 150 wolves (harvest cap of 45 wolves).

Table WLD-5. Existing Deer Winter Habitat Capability in terms of Deer Density on NFS Lands by WAA

WAA	Historic (1954) Deer Habitat Capability1/	2013 Deer Habitat Capability2/	
	Deer/mi^2	Deer/mi^2	% of Original
1315	28.3	16.7	59
1318	14.7	13.6	93
1319	20.9	16.0	77
1420	21.5	11.2	52

1/ Deer habitat capability, in deer per square mile, calculated from the deer model for winter habitat. Habitat Suitability Indices were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest was treated as even-aged; no predation was included.
2/ Values presented here are slightly lower than those presented in the 2008 Forest Plan EIS for the selected alternative because some stands have matured over time, and edits have been made to make the GIS layer more accurate.
Note: WAAs 1316, 1421, and 1422 are slightly within the project area boundary, but no actions are proposed within them.
3/Numbers calculated using data in Table WLD-3 and WAA land area (square miles; listed in the Wildlife and Subsistence Resource Report).
Source: GIS Database, deer_model.aml

The mean total annual harvest in GMU 2 from1985 to 1999 was 76 wolves, ranging from 18 to 136 wolves; from 2000 to 2009 mean total annual harvest was 49 wolves, ranging from 18 to 77 wolves (Person and Logan 2012). From 2008 to 2011, total reported harvests in GMU 2 were 24, 22, 20, and 28 wolves, respectively (B. Porter, ADF&G, personal comm. 2012). Most recently, in 2012, total annual harvest was 56 wolves (Bethune, ADF&G, personal comm. 2013).

Person and Logan (2012) suggested that all project area WAAs may have periodically experienced unsustainable harvest (annual harvest rates ≥ 3 wolves per 300 square kilometers [116 square miles]) with WAAs 1315, 1318, and 1420 having experiencing chronic unsustainable harvest (i.e., unsustainable harvest at least 5 times between 1985 and 2009). Moreover, WAAs 1315, 1318, and 1420 have experienced harvest at levels with the potential to result in pack turnover or pack depletion (annual harvest rates ≥7 wolves per 300 square kilometers [116 square miles]); at times between 1985 and 2009 the risk of pack depletion in all three WAAs may have been high (i.e., annual harvest of ≥7 wolves per 300 square kilometers (116 square miles) for at least 2 years). Note that these harvest rates are conservative in that they do not take into account illegal take and unreported harvest, which can represent a substantial portion of total annual mortality of wolves. Person and Logan (2012) stated that the occurrence of unsustainable and pack depletion harvests peaked prior to 1999.

The project area WAAs may be at risk of such overharvest (both unsustainable and pack depletion) in the future even with road closures under the Prince of Wales Access and Travel Management Plan (Person and Logan 2012; see the Wildlife and Subsistence Resource Report for additional information). Taking all years into account, the (reported) average annual wolf harvest between 1985-2009 for WAAs 1315, 1318, and 1319 was <3 wolves per 300 square kilometers (116 square miles) per year; average annual harvest over this period in WAA 1420 was at least 3 wolves per square kilometer (0.4 square mile) and thus at a level Person and Logan determined may be unsustainable (Person and Logan 2012).

Although most wolves (i.e., 59 percent) are harvested by hunters and trappers working from boats harvest-related wolf mortality is correlated with roads and other habitat features, which influence their vulnerability to harvest (Person and Russell 2008; Person and Logan 2012). Person and Russell (2008) found that rate of harvest of both resident and non-resident (e.g., those dispersing or moving through unfamiliar territory) wolves increased with density of roads, which provide access to hunters and trappers; however, road densities of 1.5 miles per square mile (0.9 kilometer per square kilometer) or greater had little additional effect on harvest rates. This study did not differentiate between open and closed roads though the authors stated that road status likely had an important influence on wolf mortality. Similarly, wolves are more easily observed in open habitats such as muskegs, meadows, and young clearcuts; therefore, use of these habitats, particularly in areas accessible to humans (i.e., the beach and roaded areas), increases the risk of harvest-related mortality (Person and Russell 2008). Harvest vulnerability may limit dispersal, and thus the ability of wolves to recolonize territories that have been vacated by trapping and hunting or maintain genetic interchange between separate populations.

The Forest Plan states that a road density of 0.7 to 1.0 mile per square mile or less may be necessary to reduce harvest-related mortality risk where locally unsustainable wolf mortality has been identified. Person et al. (1996) reported that wolf harvest increased twofold when total road density below 1,200 feet elevation exceeded 0.7 miles per square mile. Currently total road density below 1,200 feet elevation on POW is 0.99 mile per square mile, ranging from 0.7 to 2.5 miles per square mile for WAAs in the project area (Table WLD-6). These road densities exceed both the Forest Plan recommendation (0.7 miles per square mile) as well as the threshold of 1.5 miles per square mile suggested by Person and Russell (2008) in all cases except WAA 1318 where road density is 0.7 miles per square mile.

Table WLD-6. Existing Road Density below 1,200 Feet Elevation on NFS Lands

Island/WAA	Road Density by Road Status (mile/mile^2)1/, 2/		
	Open	Closed	Total3/
1315	1.07	1.06	2.14
1318	0.49	0.23	0.71
1319	0.82	0.78	1.60
1420	1.40	1.12	2.51
Prince of Wales Island	0.53	0.46	0.99

1/ Includes only NFS lands.
2/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads.
3/ Total road density may not exactly match open road plus closed road density due to rounding.

That wolves continue to be harvested from the project area WAAs at moderate to high rates suggests that the wolf population may be functioning despite being at risk of periodic, localized depletions (i.e., indicative of healthy source populations with some areas functioning as sinks) but could also be indicative of a decreased population overall with fewer wolves available to harvest. Moreover, the presence of large, undisturbed blocks of habitat on Prince of Wales Island, including the Honker Divide large OGR complex and the nearly 40,000-acre Karta Wilderness to the west and south of the project, respectively, help assure the persistence of wolf packs that may serve as source populations capable of replacing wolves that periodically disappear from adjacent disturbed lands (Person et al. 1996; Person and Logan 2012).

The ADF&G works cooperatively with the Alaska Board of Game and with Federal land managers, including the Forest Service, to identify and address conservation concerns for all wildlife in Southeast Alaska, including wolves. Through this effort revisions are proposed to regulatory entities as needs are identified. The Board of Game has made modifications to wolf hunting and trapping seasons over the years in response to information provided by agencies and the public. These regulations are intended to help ensure sustainable wolf populations and are an important part of the wolf standard and guideline.

The Forest Service is also currently participating in an interagency group referred to as the “Wolf Task Force.” This group was formed, in accordance with Forest Plan standard and guideline WILD1.XIV.A.1, to determine if there is unsustainable wolf mortality occurring on Prince of Wales Island. The group’s determination would then inform the need for a wolf habitat management plan. The group began meeting in October of 2011 although collaborative work is ongoing and no determination has been reached to date. The Forest Service and the State of Alaska are currently working to obtain more accurate wolf population estimates.

The Big Thorne project area lies within the vicinity of the Honker Divide, Steelhead, Thorne River, and Ratz Harbor wolf packs. Wolf sign was documented during goshawk surveys conducted for the Project in the Steelhead drainage, the Rio Beaver drainage, west of Rush Peak, and near Angel Lake. Biologists from ADF&G provided GIS data delineating 1,200-foot buffers centered on nine known den sites in the Big Thorne project area (Moselle, ADF&G, personal comm. 2011). These buffers overlapped four proposed harvest units. In accordance with Forest Plan standards and guidelines, the boundaries of these units were subsequently modified (or the unit was dropped) under all alternatives to eliminate portions overlapping the den site buffers.

Marten

The American marten was selected as an MIS because of its close association with old-growth forests and its importance as a furbearer. Although only one species of marten is formally recognized in Southeast Alaska two distinct lineages exist. Within the Alexander Archipelago, the coastal form *caurina* is thought to occur only on Kuiu and Admiralty Islands, though a preliminarily identified specimen of this subspecies has been collected on Dall Island (USDA Forest Service unpublished data). The continental form occurs elsewhere in their range including Prince of Wales Island (Cook et al. 2006). Marten were transplanted to Prince of Wales Island between 1930 and 1950 (MacDonald and Cook 1999).

In GMU 2, marten are managed as a furbearer. ADF&G currently permits unlimited trapping of marten in the GMU 2 from December 1 to February 15. Marten are also a subsistence species. Trapping efforts fluctuate year-to-year depending on fur prices, fuel prices, winter weather conditions, the current economy, and marten populations. Marten harvests in GMU 2 are typically high compared to elsewhere in Southeast Alaska (see the subsistence section for marten trapping statistics); however no concern has been raised about harvest levels (Shepherd and Melchior 2008).

Coastal habitats (beach fringe) and riparian areas have the highest habitat value for marten, followed by upland forested habitats below 1,500 feet in elevation (USDA Forest Service 2008a). Marten favor large- and medium-sized old-growth forests because they intercept snow, provide cover and denning sites, and provide habitat for marten prey species (Flynn and Schumacher 2001). These forests are also used by deer during winter, and winter-kill carcasses of deer represented a significant portion of marten diet in winter (Ben David et al. 1997). These forests have also experienced past timber harvest. Consequently, the quantity and quality of winter habitat is a limiting factor for marten in Southeast Alaska. Therefore, the availability of deep-snow marten habitat, defined as high-volume POG (SD 5N, 5S, and 67) below 800 feet in elevation, provides a measure of habitat quality for marten. Within the project area WAAs, the original (1954) amount of deep snow marten habitat has been reduced by between 35 and 69 percent; deep snow marten habitat within the project area as a whole has been reduced by 48 percent (Table WLD-7).

Table WLD-7. Original and Existing Deep Snow Marten Habitat

WAA	Deep Snow Marten Habitat[1/]		
	Original (1954) Acres	2012 Acres	% Change
1315	24,838	9,293	-63%
1318	22,243	7,600	-66%
1319	18,092	11,820	-35%
1420	10,075	3,166	-69%
Project Area	48,693	25,090	-48%

1/ High volume POG (SD 5S, 5N, 6/7) at or below 800 feet elevation

Due to their wide-ranging nature and close association with old-growth forest, marten were specifically considered in the design of medium-sized old-growth reserves (10,000 to 40,000 acres) under the Forest Plan Conservation Strategy (Suring et al. 1993; Flynn et al. 2004; USDA Forest Service 2008a). Large, contiguous patches of old-growth, particularly below 800 feet elevation during winter, provide the highest quality habitat for marten and marten densities are typically higher in these areas than in fragmented habitats (Hargis et al. 1999; Flynn et al. 2004). Marten also travel easily through non-commercial forests, POG, and clearcuts with established cover (Flynn et al. 2007). Thus, maintaining a matrix that facilitates movement (i.e., roadless refugia from harvest and the presence of old-growth for foraging and denning) between large, contiguous patches of old-growth is important to this species.

Assuming the minimum travel distance for marten of 8 miles (13 km) reported by Flynn (1991), and that corridors through POG are optimal, functional connectivity between OGRs in the project area for marten is as follows:

- Small OGRs in VCUs 5790, 5800, and 5840 are functionally connected to each other and to the Honker large OGR complex via VCU 5780 and 5790 (via roadless areas), and to the beach through the small OGR in VCU 5840;
- The small OGR in VCU 5950 is functionally connected (only through non-Federal land) to the Honker large OGR complex, and to the small OGR in VCU 5940;
- Small OGRs in 5960 and 5972 are functionally connected to large reserves (Honker large OGR complex and/or Karta Wilderness) and to each other (through the Karta Wilderness and roadless areas);
- Small OGRs in adjacent VCUs 5820/5830 are functionally connected to each other and (via VCU 5820 through roadless area) to the northern piece of the small OGR in VCU 5810, which is also connected to the small OGR in VCU 5720, but none are functionally connected to a larger reserve;
- The southern piece of the small OGR in VCU 5810 is functionally connected to the Honker large OGR in VCUs 5740 and 5750 (via roadless area); and
- Small OGRs in adjacent VCUs 5850/5860 are functionally connected to each other and to the small OGR in VCU 5840 through the beach buffer and a marginal connection through the VCU (due to some older [> 30 years] young-growth).

In addition to the functional connectivity across the landscape provided by the reserve system and old-growth forest in the matrix, connectivity between reserves for marten is also provided by structural elements of the Forest Plan conservation strategy including the stream, estuary, lake, and beach buffers. A discussion of travel corridors within the project area is provided in the Biodiversity subsection.

Marten populations fluctuate greatly over time in response to habitat conditions, prey densities, and trapping pressure. Timber harvest reduces habitat quality for marten through the removal of forest cover, fragmentation of old-growth habitat, and reductions in habitat for some prey species. Increased human access associated with new roads may result in increased marten harvest-related mortality. Although closed roads still facilitate access (e.g., off-highway vehicle, pedestrian), open roads receive the highest and most consistent use and therefore are likely to have the greatest effect on marten. Existing road densities (all elevations included) in the project area WAAs are listed in Table WLD-8. Roadless areas and OGRs provide refugia from trapping pressure. The Forest Plan conservation strategy provides habitat and connectivity for marten on NFS lands (USDA Forest Service 2008a).

Table WLD-8. Existing Road Density for All Elevations on NFS Lands

Island/WAA	Road Density by Road Status (mile/mile^2)[1/, 2/]		
	Open	**Closed**	**Total**
1315	0.94	0.93	1.87
1318	0.34	0.14	0.48
1319	0.61	0.58	1.19
1420	1.00	0.74	1.74

1/ Includes only NFS lands.
2/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads.

Black Bear

Black bears were chosen as an MIS because of their importance for hunting and for recreation and tourism. In Southeast Alaska, black bears are present throughout the mainland and on the islands south of Frederick Sound. Black bears in Southeast Alaska are part of a population (Alexander Archipelago black bears) endemic to coastal British Columbia and Southeast Alaska, except Admiralty, Baranof, and Chichagof islands (Stone and Cook 2000; Peacock et al. 2007).

Prince of Wales Island is known for producing large black bears and is a popular hunting location for resident and non-resident hunters. Mean annual black bear harvest from 2007-2009 was 312 bear (ADF&G 2011). Reported black bear harvest in GMU 2 peaked in 2005 and has dropped every year thereafter (ADF&G 2011). Between September 1 and June 30, resident hunters are allowed a bag limit of 2 bears and non-residents are allowed a bag limit of 1 bear; beginning in 2012 drawing permits will be required for non-resident hunters not using registered guides. This change in hunting opportunity is driven by ADF&G concerns about sustainable harvest and is intended to bring harvest in line with harvest objectives (ADF&G 2011).

Black bears will use habitats from sea level to the alpine but appear to prefer estuarine, riparian, and forested coastal habitats (USDA Forest Service 2008b). Black bears use small openings, and areas such as wetlands, clearcuts, and subalpine meadows for foraging. On Prince of Wales Island, black bears primarily forage on vegetation in the early spring, but will prey on deer fawns for a short period in late spring (Porter 2008; see the Deer subsection above for information on deer population trends within GMU 2). During summer and fall, the accumulation of fat reserves for winter hibernation is important. Berry crops are an important food source during this period, and bears that have access to salmon streams will eat large quantities of fish.

Prince of Wales Island has some of the highest quality black bear habitat in Southeast Alaska (Porter 2008). However, more timber harvest and associated road building have occurred there than in other Southeast Alaska black bear habitats (Porter 2008). Timber harvest (the removal of POG forest), decreases habitat suitability. Past timber harvest, especially in areas adjacent to salmon streams, has also decreased bear habitat suitability. While early successional habitats may provide abundant food (berries), over the long term dense young-growth stands provide poor habitat for black bears due to the lack of understory vegetation and large hollow trees for denning. Also over the long-term reduction of den sites may result from a lack of availability of large tree root structures (Davis et al. 2012). Small OGRs in the project area provide some connectivity to shoreline and riparian habitats preferred by black bears.

Timber harvest may also impact black bears through increased human access on roads. This can result in increased harvest-related mortality; however it should be noted that black bear harvest risk is not tied to a road density threshold.

Existing POG in the project area WAAs includes 27,663 acres in WAA 1315 (47 percent of the original POG existing in 1954); 32,285 acres in WAA 1318 (49 percent of the original POG existing in 1954); 47,387 acres in WAA 1319 (77 percent of the original POG existing in 1954); and 18,006 acres in WAA 1420 (56 percent of the original POG existing in 1954). The Forest Plan conservation strategy provides habitat for black bear that may provide suitable den sites.

Black bears and sign were observed in the Big Thorne project area during field surveys. Biologists from ADF&G provided GIS data delineating 300-foot buffers centered on known black bear den sites in the Big Thorne project area (Moselle, ADF&G, personal comm. 2011). The 2008 Forest Plan does not require den buffers, so the distance of 300 feet was selected because it was deemed adequate by to avoid disturbing black bear dens during timber harvest activities based on recommendations by ADF&G black bear biologists (Moselle, ADF&G, personal comm. 2011). These buffers, applied to all alternatives, overlapped one proposed harvest unit, which was subsequently modified to eliminate the portions of the unit that overlapped the den site buffer. Other known dens sites were not within or immediately adjacent to proposed harvest units. An additional bear den discovered subsequent to the finalization of the Draft EIS unit pool was incorporated into the Final EIS unit pool.

Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper

The hairy woodpecker, red-breasted sapsucker, and brown creeper were selected as MIS to represent old-growth-associated and snag-dependent species. Although no historic population estimates exist, it is likely that timber harvest and associated activities have reduced populations from current levels (Raphael 1988; Hejl et al. 2002). North American Breeding Bird Survey (BBS) data collected between 1966 and 2005 suggest populations of all three species are increasing in Alaska, although statistically significant state-wide trends have only been detected for the red-breasted sapsucker and results maybe confounded by inadequate sample sizes (Sauer et al. 2005). Additional trend information is provided in the Wildlife and Subsistence Resource Report (Woeck 2013a).

Hairy woodpeckers and red-breasted sapsuckers are primary cavity excavators that require snags and dying trees for foraging and nesting. The hairy woodpecker is typically associated with high-volume POG (SDM 5S, 5N, 67) whereas the red-breasted sapsucker is typically associated with low-volume POG (SD4H category; USDA Forest Service 2008b). The brown creeper requires large diameter old-growth trees (large-tree POG;

SD67 type). There are 98,654 acres of POG, including 22,116 acres of large-tree POG and 24,297 acres of low-volume POG, in the project area (Table WLD-1).

All three species are associated with interior forest conditions (Kissling and Garton 2008). In a study of the responses of forest-dwelling birds varying forested beach buffer widths in Southeast Alaska, hairy woodpeckers and brown creepers were absent from forest buffers less than 830 feet wide (250 meters wide), indicating that these species may avoid edge habitats; 83 percent of brown creepers were detected in undisturbed control plots (Kissling 2003; Kissling and Garton 2007). Densities of red-breasted sapsuckers were positively correlated with buffer width, with the greatest densities occurring in buffers at least 1,000 feet wide (300 meters wide; Kissling 2003). Thus these species area sensitive to fragmentation and reductions in POG patch sizes. Within the project area, there are approximately 52,041 acres of interior forest habitat (POG and unproductive forest 660 feet (200 m) or farther from clearcuts and other non-forest vegetation types (Concannon 1995). Maintenance of habitat for these species is provided by the Forest Plan conservation strategy (USDA Forest Service 2008a).

Timber harvest activities that remove large, live trees and dead or dying trees reduce nesting and foraging habitat for these species (Hejl et al. 2002). Timber harvest may also reduce local habitat quality by creating fragmented forest patches, reducing the amount of interior forest habitat with which these species are associated. Brown creeper and hairy woodpecker would be most affected by harvest activities that reduce the number of large diameter trees and snags. Red-breasted sapsuckers were observed during 2010 wildlife surveys; no hairy woodpeckers or brown creepers were recorded but suitable habitat is present.

Vancouver Canada Goose

The Vancouver Canada goose was selected as an MIS because of its association with wetlands (both forested and non-forested) in the estuary, riparian, and upland areas of the Forest (USDA Forest Service 2008b). The Vancouver Canada goose is a primarily a non-migratory waterfowl species that occurs year-round throughout Southeast Alaska (Hupp et al. 2010). However, geese do move locally between nesting, brood rearing, molting, and wintering grounds. This species nests in forested habitats associated with beach fringe, estuary fringe, and riparian habitats. Hupp et al. (2010) documented nests in forests adjacent to muskegs. During winter, marine grasses and salt marsh plants commonly found in intertidal areas are important forage resources, and Vancouver Canada geese exhibit strong fidelity, returning repeatedly to such winter sites (Fox 2008).

Timber harvest activities may result in disturbance to geese, particularly if they occur in the vicinity of nest sites or brood rearing areas. However, timber harvest in these areas has generally been minimal because these sites are fairly unproductive. Protection from direct impact to habitat is provided by Forest Plan Standards and Guidelines for waterfowl habitat, stream, and lake buffers; overall goose habitat is provided by the Forest Plan conservation strategy (USDA Forest Service 2008a).

Potential habitats for Vancouver Canada geese in the Big Thorne project area include the shorelines of lakes, including Luck Lake, Little Lake, Big Lake, Trumpeter Lake, Power Lake, Angel Lake, Control Lake, and other small lakes in the area. Potential habitat is also located in the forested riparian and estuarine areas. There are 57,450 acres of forested wetlands in the project area (see Wetlands section of the Final EIS for additional discussion; Table WET-1).

Species of Concern

The U.S. Fish and Wildlife Service and the Forest Service have identified the following species as species of concern. These species are not currently listed as threatened or endangered.

Marbled Murrelet

Marbled murrelets are widely distributed across marine waters in Southeast Alaska. They spend the majority of their lives at sea, but travel inland up to 50 miles to nest in old-growth forest stands (Piatt et al. 2007). Marbled murrelets typically nest on mossy-limbed branches of large, mature coniferous trees within stands of structurally complex, coastal high-volume old-growth forest (DeGange 1996; Kuletz et al. 1995; Ralph and Miller 1995). However, on some treeless islands in Southeast Alaska marbled murrelets lay eggs on bare talus slopes in mountainous areas (Piatt et al. 2007). Nests can be very difficult to find and only six nests have been found in Southeast Alaska (USDA Forest Service 2003a).

Timber harvest, through the removal of POG forest, can directly remove nest trees, and also increases habitat fragmentation and associated edge effects, such as increased rates of nest predation (Andren 1994; Chalfoun et al. 2002). As forest patch size decreases through fragmentation, forest-edge habitat and predator access increase. Some avian predators of murrelets, especially corvids (i.e., ravens, crows, jays), are known to increase both with forest fragmentation and proximity to human activity (Burger 2002). In a study of the edge effects and nest predation risk on marbled murrelets, Malt and Lank (2007) found that disturbances by avian predators at nests were significantly more frequent at hard edges (clearcuts) relative to interiors, but less frequent at soft edges (regenerating forest); there were no edge effects at natural-edged (riparian) sites. Thus, edge-associated predation risk may subside with the progression of forest succession. Forest Plan standards and guidelines pertaining to marbled murrelets include maintaining a 600-foot radius no-cut buffer zone around identified murrelet nests (Forest Service 2008a).

Within the project area, approximately 67 percent of the original (1954) POG and 58 percent of the original high-volume POG remains which provides suitable marbled murrelet nesting habitat (Table WLD-1). Past timber harvest has resulted in fragmentation of nesting habitat (see the Biodiversity section for a discussion of existing POG patch sizes in the project area). No nests were documented during 2010 and 2011 field surveys though nest surveys specific to murrelets were not conducted. A dead marbled murrelet was observed.

Prince of Wales Flying Squirrel

The Prince of Wales flying squirrel is endemic to the Prince of Wales Island complex (Demboski et al. 1998; Smith 2005). The flying squirrel plays an essential role in the dynamics of coniferous forest ecosystems (Carey 2000a) because it disperses ectomycorrhizal fungi (Maser and Maser 1988), a food source that is lacking in young-growth forest (Flaherty et al. 2008). It is a species of concern on Prince of Wales Island because of this close association with old-growth forest structure and processes and because of its specific habitat requirements for efficient movement (Carey 2000a; Scheibe et al. 2006).

On September 30, 2011, the USFWS received a petition to list the Prince of Wales flying squirrel as threatened or endangered under the ESA. On August 29, 2012, the USFWS announced a 90-day finding that the petition did not present substantial information indicating that listing this subspecies may be warranted (FR 52301-52308). Therefore, at this time the petition will not move forward for additional review.

Prince of Wales flying squirrels are associated with POG and dens sites are typically located in areas with lower levels of fragmentation than elsewhere on the landscape (Pyare et al. 2010). The Prince of Wales flying squirrel is capable of crossing open areas such as meadows or riparian zones; however, this subspecies has a limited gliding range (approximately 250 feet), a distance substantially less than the average clearcut width (Flaherty et al. 2008). Recent research also indicates that the Prince of Wales flying squirrel relies on its olfactory, auditory, and visual senses for movement which are limited in clear-cuts (perceptual range of 328-492 feet) and young-growth forests (perceptual range of 82-164 feet; Flaherty et al. 2008). Flaherty et al. (2008) speculated that Prince of Wales flying squirrels are unlikely to venture beyond their perceptual ranges, and thus may become isolated by large clearings (i.e., those that exceed 250 feet). Thus, successful dispersal of the species depends on the functional connectivity of the landscape (Smith et al. 2005).

Under the Forest Plan Conservation Strategy, the system of small OGRs was designed to provide for the distribution of flying squirrels in every major watershed and facilitate functional connectivity between larger reserves (USDA Forest Service 1997a). Small OGRs were intended to support small, persistent populations of flying squirrels between larger source populations that collectively function as a metapopulation interacting through the matrix. However, based on flying squirrel movement capabilities, Pyare and Smith (2005) concluded that fewer than half of the small OGRs on northern Prince of Wales Island (including the project area) appear to be functionally connected to a source population. Moreover, Smith and Person (2007, as cited in Smith et al. 2011) hypothesized that flying squirrels populations might not persist over the long term in isolated small OGRs because the minimum patch size required to sustain a population is greater than minimum acreage requirements for small OGRs required under the Forest Plan. Small OGRs contribute to the connectivity between source populations in medium and large reserves, and therefore must either sustain sink populations long enough to ensure successful emigration to other reserves or must be close enough to larger reserves to support a back-and-forth exchange (Smith et al. 2011).

Smith et al. (2011) suggest that spacing small OGRs at a maximum distance of 0.6 mile (1 kilometer) through old-growth habitat would probably facilitate the recolonization of vacant reserves and supplementation of existing populations. Based on this suggested spacing, functional connectivity within the project area (existing small OGRs) is as follows:

- Small OGRs in VCUs 5790, 5800, and 5840 are functionally connected to each other and to the Honker large OGR and saltwater complex via VCU 5780;

- The small OGRs in VCU 5950 is functionally connected (only through its northeast corner through non-Federal land) to the Honker large OGR complex, and to the small OGR in VCU 5940;
- Small OGRs in 5960 and 5972 are functionally connected to large reserves (Honker large OGR complex and/or Karta Wilderness);
- Small OGRs in adjacent VCUs 5820/5830 and 5850/5860 are functionally connected to each other, but not to any other reserve; and
- The northern and southern pieces of the small OGR in VCU 5810 are functionally connected to each other through the stream buffer along Luck Creek but not to any larger reserves, and the northern piece of small OGR is functionally connected to the small OGR in VCU 5720 but not to a large reserve, and the southern piece would remain functionally connected to the Honker via roadless.

In addition to the functional connectivity across the landscape provided by the reserve system, legacy standards and guidelines, and old-growth forest in the matrix, connectivity between reserves for flying squirrels is also provided by structural elements of the Forest Plan conservation strategy including the stream, estuary, lake, and beach buffers. A discussion of travel corridors within the project area is provided in the Biodiversity subsection.

Within the project area VCUs, between 40 to 100 percent of the original (1954) POG remains providing suitable habitat for flying squirrels (Table WLD-1). Past timber harvest has likely affected flying squirrel populations where clearcut size is larger than their maximum gliding range, or where scattered tall conifers in large cuts have not been retained as cover and for travel across the open spaces. These conditions may hinder dispersal and result in the creation of isolated populations.

Prince of Wales Spruce Grouse

The Prince of Wales spruce grouse is a subspecies that is endemic to Prince of Wales and nearby islands in southern Southeast Alaska. The Prince of Wales Island spruce grouse is associated with muskegs, POG, and mixed conifer (scrub) habitats but will also use young-growth forest (15-30 years following timber harvest) with a well-developed middle story; they avoid clearcuts (Russell 1999). Though they are closely associated with conifer forests, the highest densities of spruce grouse are supported by areas with a mosaic of older coniferous habitats interspersed with regenerating patches of dense trees. The existing amount of POG within the project area VCUs ranges from 1,516 acres in VCU 5971 to 11, 141 acres in VCU 5750, and is presented in Table WLD-1.

Denser forest stands are selected during winter because they intercept snow. Grouse also select habitats with abundant shrubs and herbaceous plants where cover and forage are available during summer. Prince of Wales spruce grouse eat Sitka spruce needles and buds, western hemlock needles, and *Vaccinium* species (e.g., blueberries; Russell 1999). Spruce grouse are poor long-distance flyers and are generally sedentary, with some limited migratory movement (typically less than a mile; Dickerman and Gustafson 1996) between summer and winter habitats (Boag and Schroeder 1992; Williamson et al. 2008).

Spruce grouse are an important prey species for goshawks and marten. Forest birds, including spruce grouse, comprised a larger proportion of goshawk diets during the breeding season on Prince of Wales Island than elsewhere in Southeast Alaska (Lewis et al. 2006). Thus, impacts to spruce grouse could also impact goshawk and marten populations. Spruce grouse are managed as a game species by ADF&G. In GMU 2, taking of spruce grouse is allowed between August 1 and May 15, with a bag limit of five per day.

Changes in forest structure, (e.g., timber harvest or windthrow) associated with fragmentation may lead to population declines if open areas are too large or forested patches are spread too far apart to enable spruce grouse to move between them (greater than 1 mile). Clearcuts may also present a dispersal barrier to this species due to the thick logging debris often present which could inhibit walking, this species preferred method of movement (Russell 1999). The existing level of fragmentation (POG patch sizes) is presented in table WLD-2. There are currently 454 POG patches (including all size classes) in the project area.

Spruce grouse are particularly vulnerable to hunting along road systems, and thus are susceptible to overexploitation near roads and human populations (Williamson et al. 2008; Rabe 2009). Nelson (2010) found no effect between unharvested and harvested habitats on the short-term survival of radio-marked Prince of Wales spruce grouse; however, this study did not differentiate between age of past harvest or between types of unharvested habitat. Existing total road densities (calculated by WAA) on NFS lands in the project area, range from 0.45 in WAA 1318 to 1.87 in WAA 1315, and are presented in Table WLD-8. The Forest Plan conservation strategy maintains connectivity within matrix lands that will help facilitate dispersal and interchange between isolated spruce grouse populations.

Endemic Species

The Federal ESA defines endemic as “a species native and confined to a certain region; having comparatively restricted distribution.” Forest Plan standards and guidelines for endemic mammals direct the Forest to “maintain habitat to support viable populations and improve knowledge of habitat relationships of rare or endemic terrestrial mammals that may represent unique populations with restricted ranges.” Likewise, the NFMA directs that management prescriptions “shall preserve and enhance the diversity of plant and animal communities, including endemic(s).”

Due to its archipelago geography and highly dynamic glacial history, Southeast Alaska has been found to be a region with an especially high degree of endemism (Demboski et al. 1998). Approximately 20 percent of the small mammal taxa (species and subspecies) known to occur in Southeast Alaska are endemic to an island or a group of islands (Dawson et al. 2007). There remain many uncertainties about the extent of endemism in Southeast Alaska because research to date has primarily focused on mammals, thus the level of endemism in other organisms such as plants, birds, amphibians, and invertebrates is unknown. The Prince of Wales Island complex appears to be an endemic hotspot based on evidence that it was refugia during the last glacial event (Cook et al. 2001, 2006). The following species are endemic and occur on Prince of Wales Island (ISLES 2009):

- Alexander Archipelago wolf: endemic to Southeast Alaska (Weckworth et al. 2005; discussed above);
- Prince of Wales Flying Squirrel: endemic to the Prince of Wales Island complex (Bidlack and Cook 2001, 2002; discussed above);
- Haida Gwaii ermine (*Mustela erminea haidarum*): endemic to Haida Gwaii, British Columbia, Canada and the Prince of Wales Island complex (Fleming and Cook 2002); closely associated with riparian and shoreline areas at low elevations (Reid et al. 2000); Note that these areas are protected by Forest Plan standards and guidelines;
- Keen's myotis (*Myotis keenii*): endemic to the Southeast Alaska and British Columbia, recorded from Juneau south (MacDonald and Cook 2007); selects roost sites in forest patches with greater availability of large-diameter trees with decay for roosting and that were close to streams (Boland et al. 2009; existing POG is discussed above in the Biodiveristy section (Table WLD-1);
- Alexander Archipelago black bear: endemic to coastal British Columbia and Southeast Alaska, except Admiralty, Baranof, and Chichagof islands (Stone and Cook 2000; discussed above);
- Prince of Wales Spruce Grouse: endemic to Prince of Wales Island and nearby islands including Heceta, Suemez, Warren, and Zarembo; also reported on Mitkof Island (Dickerman and Gustafson 1996; discussed above).

Timber harvest has the potential to remove habitat used by endemic species, such as snags and hollow trees used by the Keen's myotis and the Prince of Wales flying squirrel; but may also create habitat for some species (e.g., regenerating forest stands for spruce grouse). Existing POG within the project area VCUs is presented in Table WLD-1. Fragmentation of habitat patches resulting could limit the ability of some species (e.g., flying squirrels) to disperse between areas of suitable habitat (the existing level of fragmentation in the project area is presented in Table WLD-2). In addition, for those species that are hunted (such as black bear and spruce grouse), project roads have the potential to increase hunter access and thus may increase harvest rates along the road system and the areas that these roads access (there are no known thresholds relative to road density for most of these species). Due to their restricted ranges, specific habitat requirements, and sensitivity to human activity, insular endemic species (i.e., those restricted to islands or groups of islands) are highly susceptible to extirpation and eventually extinction (Soule 1983; Reid and Miller 1989; Burkey 1995). Species tied to island archipelagos are more sensitive to the effects of introduced non-natives, including pathogens and disease, and natural events, such as climate change, than other managed landscapes due to their limited mobility and isolation from other subpopulations (Cook et al. 2006).

Migratory Birds

Executive Order 13186 provides for the conservation of migratory birds and their habitats and requires the evaluation of the effects of Federal actions on migratory birds, with an emphasis on species of concern. Agencies are required to support the conservation and intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions.

Birds protected under the Migratory Bird Treaty Act (MBTA) include all common songbirds, waterfowl, shorebirds, hawks, owls, eagles, ravens, crows, native doves and pigeons, swifts, martins, swallows, and others, including their body parts (e.g., feathers, plumes), nests, and eggs. Prince of Wales Island is part of the Southeastern Biogeographic Region of Alaska, one of five Biogeographic Regions in Alaska (based on the Commission for Environmental Cooperation's hierarchical framework of nested ecological units) in which priority species, habitats, and conservation actions are identified under the Boreal Partners in Flight (BPIF) Alaska Landbird Conservation Plan (BPIF 1999). Priority migratory bird species identified in the Landbird Conservation Plan (BPIF 1999, 2011) with the potential to occur in the Big Thorne project area are listed in Table WLD-9. Of these species, 14 species use hemlock/spruce/cedar forest as primary habitat for known or probable breeding; the remaining 5 use this forest as secondary habitat. Marbled murrelets (addressed under Species of Concern), and goshawks (addressed below) are also protected by the MBTA.

Table WLD-9. Priority Landbird Species Potentially Occurring in the Big Thorne Project Area

Common Name[1/]	Scientific Name	Potential Occurrence in Vicinity of the Big Thorne Analysis Area
western screech owl	*Otus kennicottii*	Breeding, Winter
black swift	*Cypseloides niger (borealis)*	Breeding
Vaux's swift	*Chaetura vauxi*	Migration Breeding
rufous hummingbird	*Selashorus rufus*	Migration, Breeding
red-breasted sapsucker	*Sphyrapicus ruber*	Breeding
olive-sided flycatcher	*Cantopus cooperi*	Breeding
western wood-pewee	*Contopus sordidulus*	Breeding
Hammond's flycatcher	*Empidonax hammondii*	Breeding
Pacific-slope flycatcher	*Empidonax difficilis*	Breeding
Steller's jay	*Cyanocitta stelleri*	Breeding, Winter
northwestern crow	*Corvus caurinus*	Breeding, Winter
chestnut-backed chickadee	*Poecile rufescens*	Breeding, Winter
American dipper	*Cinclu mexicanus*	Breeding
varied thrush	*Ixoreus naevius*	Migration, Breeding, Winter
Townsend's warbler	*Dendroic townsendi*	Breeding
blackpoll warbler	*Dendroica striata*	Migration
MacGillivray's warbler	*Oporornis tolmiei*	Breeding
golden-crowned sparrow	*Zonotrichia atricapilla*	Breeding, Winter
golden-crowned kinglet	*Regulus satrapa*	Breeding, Winter

1/ The blue grouse is also included on the priority list for Southeastern Alaska Region (BPIF 1999, BPIF 2011) but does not occur on Prince of Wales Island.

The main management issue for migratory birds in the Southeastern Alaska Biogeographic Region is the harvest of POG forests. Timber harvest directly removes perching, foraging, and nesting habitat and results in habitat fragmentation, which may reduce the suitability of remaining forest for species associated with interior forest conditions, such as the Townsend's warbler (Kissling 2003; Sperry 2006). There are 98,654 acres of POG in the project area (Table WLD-1). Fragmentation may increase the exposure of birds to edge-related predators and parasites, though there remain many unknowns about the effects of fragmentation on landbird populations in Alaska (Robinson 1992; Hoover et al. 1995; BPIF 1999). As the landscape becomes more fragmented, forest buffers become increasingly important for migratory birds to mitigate the effects of habitat loss (Kissling 2003). The existing level of fragmentation in the project area (POG patch sizes) is presented in table WLD-2; there are 454 POG patches in the project area. Riparian forests are also important for many species, such as the western screech owl, western wood-pewee, and Hammond's flycatcher. This habitat has been altered by road construction and other human activities; however the Forest Plan conservation strategy maintains these areas therefore mitigating some of the effects. Timber harvest and related activities may also directly impact migratory birds through disturbances of adults or young through the removal of active bird nests or by causing nest abandonment. Migratory birds are likely to be present in the project area in upland forest, riparian, and coastal habitats. Migratory bird habitat is maintained by elements of Forest Plan conservation strategy.

Threatened, Endangered, Candidate, and Sensitive Species

Threatened, endangered, and candidate species potentially occurring in the project area were identified through consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). Table WLD-10 provides a comprehensive list of these species and identifies those carried forward in the analysis based on known occurrences or the presence of suitable habitat in the project area. These species are addressed in detail in the wildlife BA/BE (Woeck 2013b) for the project, which is included in the Big Thorne Project record. For the remaining species, the project area is outside of their known range or suitable habitat is not present in the project area. Therefore, Big Thorne Project will have no effect on these species and they are not addressed further.

Forest Service Alaska Region Sensitive Species potentially occurring in the project area were obtained from the most recent Regional Forester's list (Regional Forester's Sensitive Species List 2009; Table WLD-10). The Queen Charlotte goshawk, yellow-billed loon, and black oystercatcher have the potential to occur in the project area. A detailed discussion of the Queen Charlotte goshawk is provided below because this species is associated with the old-growth forest ecosystem. The black oystercatcher, associated with rocky shorelines along the coast (areas protected by the 1,000-foot beach buffer), and the yellow-billed loon, associated with freshwater lakes, are discussed in the BA/BE.

Table WLD-10. Threatened, Endangered, Candidate, and Alaska Region Sensitive Species in the Big Thorne Project Area

Common Name	Scientific Name	Habitat Association	Potential for Occurrence in the Project Area	Status[1/]
Species Under USFWS Jurisdiction				
Kittlitz's murrelet	*Brachyramphus brevirostris*	Breeds in the vicinity of glaciers and cirques in high elevation alpine areas with little or no vegetative cover; northern Gulf of Alaska and Bering Sea coast (Day et al. 1999).	No, due to lack of suitable habitat.	C; FSS[2/]
Eskimo curlew	*Numenius borealis*	Arctic tundra.	No, outside of species' range.	FE
Short-tailed albatross	*Phoebastria albatrus*	Winters in waters of the Bering Sea, Aleutian Islands, and Gulf of Alaska; breeds in Japan (USFWS 2011).	No, outside of species' range.	FE
Spectacled eider	*Somateria fischeri*	Coastal waters in northern and western Alaska (USFWS 1999).	No, outside of species' range.	FT
Steller's eider	*Polysticta stelleri*	Occurs in northern and western Alaska (USFWS 2007a).	No, outside of species' range.	FT
Yellow-billed loon	*Gavia adamsii*	Nests near freshwater lakes in the arctic tundra and winters along the Alaskan coast to the Puget Sound (USFWS 2009).	Yes, may occur during migration; no suitable habitat on the Tongass.	C; FSS
Polar bear	*Ursus maritimus*	Sea ice and coastlines of western Alaska and along the North Slope.	No, outside of the species' range.	FT
Pacific walrus	*Odobenus rosmarus divergens*	Continental shelf waters of Bering and Chukchi seas.	No, outside of the species' range.	C
Species Under NMFS Jurisdiction				
Blue whale	*Balaenoptera musculus*	Off-shore (pelagic) marine waters of the Bering Sea, Chukchi Sea, North Pacific Ocean and/or Gulf of Alaska (NMFS 2009a). Critical habitat designated for North Pacific right whales in the Bering Sea and the Gulf of Alaska (NMFS 2009a).	No, very rarely observed in Southeast Alaska.	FE
Beluga whale	*Delphinaperus leucas*			
Bowhead whale	*Blaena mysticetus*			
Northern Pacific right whale	*Eubalaena japonica*			
Sei whale	*Balaenoptera borealis*			
Sperm whale	*Physeter macrocephalus*			
Humpback Whale	*Megaptera novaeangliae*	Common in the inside waters of the Alexander Archipelago and are regularly sighted in the Inside Passage and coastal waters of the Southeast Alaska panhandle (NMFS 1991).	Yes, likely to occupy marine waters around Prince of Wales Island. May occur in shallow coastal areas near the Project.	FE

Table WLD-10. Threatened, Endangered, Candidate, and Alaska Region Sensitive Species in the Big Thorne Project Area (cont.)

Common Name	Scientific Name	Habitat Association	Potential for Occurrence in the Project Area	Status[1/]
Fin whale	*Balaenoptera physalus*	Typically off-shore (pelagic) marine waters of the Bering Sea, Chukchi Sea, North Pacific Ocean and/or Gulf of Alaska (NMFS 2009a); two more recent sightings in lower Clarence Strait (Dahlheim et al. 2009)	Yes, may occur seasonally in marine waters around Prince of Wales Island, but in proximity to the open ocean.	FE
Bearded seal	*Erignathus barbatus*	Sea-ice habitats in Bering Sea, Chukchi Sea, Beaufort seas (Federal Register 2008).	No, species do not occur in the project area.	C
Ringed Seal	*Phoca hispida*			
Spotted Seal	*Phoca largha*			
Northern sea otter, SW Alaska population	*Enhydra lutris kenyoni*	Coastal marine habitats.	No, population does not occur in the project area.	FT
Steller sea lion – Western AK DPS[3/]	*Eumetopias jubatus*	Marine and terrestrial areas from Prince William Sound westward (west of 144° west longitude).	No, DPS does not occur in project area.	FE
Steller sea lion – Eastern AK DPS[3/]	*Eumetopias jubatus*	Marine and terrestrial areas in Southeast Alaska (east of 144° west longitude).	Yes, occurs in waters surrounding the Tongass.	FT
Green sea turtle	*Chelonia mydas*	Occur in the Gulf of Alaska and some species are found as far west as the Aleutian Islands. Adults are highly migratory, but the details and locations of migrations are largely unknown (NMFS 2009b).	No, only rarely observed in Southeast Alaska.	FT
Loggerhead sea turtle	*Caretta caretta*			FT
Olive Ridley sea turtle	*Lepidochelys olivacea*			FT
Leatherback sea turtle	*Dermochelys coriacea*			FE
Chinook Salmon	*Oncorhynchus tshawytshca*	Originate in freshwater habitats Washington, Idaho, Oregon, and California; migrate through the Gulf of Alaska (USDA Forest Service 2008b).	Possible, primarily occur outside waters of Southeast Alaska (USFS 2008). Occurrence in inside Southeast Alaska waters has been documented, but infrequently.	FT or FE depending on run
Snake River Sockeye Salmon	*O. nerka*			
Steelhead	*O. mykiss*			
Coho Salmon	*O. kisutch*			
Green Sturgeon	*Acipenser medirostris*	Spawns in the Sacramento River; very low likelihood of occurrence in southeast Alaska waters during the marine phases of its lifecycle (Colway and Stevenson 2007; Lindley et al. 2008; Huff 2012)	No, only rarely occurs in Southeast Alaska.	FT

Table WLD-10. Threatened, Endangered, Candidate, and Alaska Region Sensitive Species in the Big Thorne Project Area (cont.)

Common Name	Scientific Name	Habitat Association	Potential for Occurrence in the Project Area	Status[1/]
Forest Service Alaska Region Sensitive Species				
Southeast Alaska Pacific Herring	*Clupea pallasii*	Spawns and rear in nearshore waters.	Yes, likely to occupy marine waters around Prince of Wales Island. May occur in shallow coastal areas near the project.	C, FSS[2/]
Queen Charlotte goshawk	*Accipiter Gentiles laingi*	Mature/old growth forests.	Yes, known to occur on Prince of Wales Island and suitable habitat present.	FSS
Aleutian Tern	*Sterna aleutica*	Nests on islands, shrub-tundra, grass or sedge meadows and freshwater and coastal marshes.	No, outside of species' range.	FSS
Black oystercatcher	*Haematopus bachmani*	Rocky shorelines along the coast; forages in sheltered areas where low-sloping gravel or rock beaches with abundant prey occur.	Yes, suitable habitat present.	FSS

1/ FT = Federally threatened; FE = Federally endangered; C = candidate for Federal listing; FSS = Forest Service Alaska Region Sensitive Listed Species
2/ The "Species under USFS Jurisdiction" portion of this table lists the Forest Service Sensitive species that do not also have an ESA status; however, note that some of the ESA species are also Forest Service Sensitive species
3/DPS = Distinct Population Segment

Queen Charlotte Goshawk

The Queen Charlotte goshawk is of special concern to the State of Alaska (Cotter 2007) and has been included by Stenhouse and Senner (2005) on Audubon's Alaska WatchList. The Queen Charlotte goshawk is recognized as a distinct subspecies of the northern goshawk (*Accipiter gentilis*) that occurs only in coastal areas of British Columbia and in Southeast Alaska. In 2007, in response to a court-ordered remand on a petition to list the species, the USFWS updated a 1997 status review for the Queen Charlotte goshawk, and concluded that Alaska supports a DPS of this species though listing of this DPS was not warranted (USFWS 2007b). On August 1, 2012, the British Columbia DPS of the Queen Charlotte goshawk was listed as threatened under the ESA (FR 45870-45893). The Alaska DPS was not listed in part due to the protections provide by the Tongass Forest Plan Conservation Strategy.

The goshawk is a year-round resident in Southeast Alaska and may occupy different or overlapping breeding and winter territories. Goshawk breeding territories can be described hierarchically in terms of the nest site, the nest area, post-fledging area (PFA), and foraging area (see Reynolds et al. 1992 and the project BA/BE for detailed descriptions). Goshawks in Southeast Alaska typically nest in large, contiguous patches of tall, mature, and old trees with dense canopies. When mature and old-growth habitats are not available they will nest in maturing young-growth with sufficient structure (Reynolds et al. 2006; Boyce et al. 2006).

Goshawk foraging areas typically consist of mature and old-growth forest stands, though they will also forage in young forest as well as along edges and in openings as long as suitable perches from which to observe and attack prey are present (Iverson et al. 1996, Bosakowski et al. 1999; McClaren 2004; Boyce et al. 2006; Reynolds et al. 2006).

Goshawks consume a wide variety of prey species and are capable of alternating between prey species, depending on prey occurrence and availability. Primary prey species for goshawks on Prince of Wales Island include spruce grouse, Steller's jays, and ptarmigan, all of which are forest-dwelling birds (Lewis 2001). Prince of Wales Island is a relatively prey-poor area compared to the rest of Southeast Alaska because it does not support blue grouse or red squirrels, two important prey species for goshawks (Lewis et al. 2006). Goshawks on Prince of Wales Island have been documented moving great distances to forage, particularly during times of low prey abundance (McClaren 2004; Titus et al. 2006).

Timber harvest may locally limit the availability of nest sites through the removal of suitable nest trees, or through the removal of forest surrounding these trees (POG). Nest trees optimally should be surrounded by patches of mature or old-growth forest large enough to include several alternate nests and provide post-fledging habitat. Timber harvest may also decrease foraging habitat quality through reductions in prey abundance and availability. The availability of adequate prey resources has been linked to goshawk territory occupancy and breeding success (Doyle and Smith 1994; Salafsky et al. 2005; Keane et al. 2006, Salafsky et al. 2007). Conservation measures for this species include nest habitat and legacy forest structure standards and guidelines under the Forest Plan (USDA Forest Service 2008a). The system of old-growth reserves (OGRs) and other non-development LUDs also maintain habitat for this species, although a recent study suggests that some uncertainty remains with respect to the ability of Forest Plan conservation measures to contribute sufficient habitat to sustain well-distributed, viable populations of northern goshawks throughout Southeast Alaska (Smith 2013).

Within the North Central Prince of Wales Island biogeographic province, there are currently approximately 569,005 acres of POG, of which 248,324 acres are high-volume POG that provide potential goshawk habitat (Table WLD-1). High-volume POG represents optimal nesting habitat due to the presence of large trees and snags. This represents approximately 70 percent of the original total POG and 62 percent of the original high-volume POG existing in 1954, the time at which commercial timber harvest on the Tongass National Forest commenced. The project area VCUs contain 40 to 100 percent of the original (1954) total POG, and 18 to 100 percent of the original high-volume POG (Table WLD-1). Research from the Queen Charlotte Islands and elsewhere in western North America suggests that landscapes consisting of 40 to 60 percent mature or old forest (e.g., POG and mature young-growth) are favored by goshawks for foraging and nesting (Reynolds et al. 1992; Finn et al. 2002; Doyle 2005). For the purposes of this analysis, mature young growth was defined as natural and harvested young-growth stands 50 years or older because this is the minimum age at which suitable structure for nesting goshawks may be achieved (McClaren 2003 as cited in USFWS 2007b). Currently, seven project area VCUs maintain at least 50 percent cover of POG and mature young-growth; within the project area as a whole, approximately 45 percent of the landbase below timberline consists of POG and mature young-growth (Table WLD-11).

Table WLD-11. Landscape Composition in Relation to Goshawk Habitat Requirements

VCU[3/]	Original (1954) % POG and Mature Young-Growth	Existing (2012) Landscape Composition (Acres and % of Landbase[2/])										
		Productive Old-growth (POG)		Mature Young-Growth[1/]		Young Young-Growth		Unproductive Forest		Non-forested		Total
		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres
5720	76	3,756	38	522	6	3,269	33	1,006	10	1,300	13	9,882
5740	70	13,752	56	16	0	3,528	14	2,949	12	4,326	18	24,570
5750	69	9,927	66	0	0	4,62	3	2,558	17	2,045	14	14,992
5760	55	6,570	51	0	0	551	4	3,475	27	2,405	19	13,001
5780	76	3,656	56	0	0	1,258	19	580	9	1,012	16	6,507
5790	77	2,393	28	9	0	4,249	50	1,042	12	861	10	8,554
5800	77	4,856	50	0	0	2,701	28	1,024	11	1,147	12	9,728
5810	79	5,048	34	0	0	6,597	45	1,420	10	1,677	11	14,776
5820	77	2,262	76	7	0	47	2	378	13	263	9	2,957
5830	77	4,146	41	1,411	14	2,373	23	1,101	11	1,128	11	10,160
5840	79	5,299	45	0	0	4,166	35	1,571	13	787	7	11,824
5850	73	2,824	29	26	0	4,356	44	1,693	17	942	10	9,841
5860	86	6,323	38	494	3	7,332	45	1,073	7	1,229	7	16,459
5950	63	6,110	35	0	0	4,803	28	3,888	22	2,570	15	17,373
5960	46	5,097	44	0	0	195	2	3,799	33	2,427	21	11,518
5971	56	1,516	47	0	0	301	9	787	24	641	20	3,246
5972	63	7,016	39	16	0	4,382	25	3,920	22	2,531	14	17,870
5980	66	5,337	37	932	7	3,188	22	3,357	23	1,494	10	14,308
Project Area	70	86,599	45	1,923	1	47,359	25	31,569	16	25,990	13	193,488

1/ Mature young-growth includes harvested and natural young-growth stands 50 years old or older (McClaren 2003; CFCI 2012).
2/ Landbased excludes alpine (assumed to be all areas above 1,500-foot elevation). **Note that acreages are lower than those presented in the Biodiversity section due to the elevation cut-off.
3/ Includes total VCU area, including portions extending outside the project area boundary.

Between 1991 and 1999, five nest areas were documented on Prince of Wales Island (Flatten et al. 2001): near Logjam Creek, Rio Roberts/Cutthroat drainage, Sarheen Creek, Sarkar Lake, and Twelvemile arm. Nesting activity has not been documented at any of these nest sites since the 1990s, and although there have been goshawk sightings no new nests in these areas have been found (ADF&G 1999; Dillman 2009). One nest was located in the Big Thorne project area within the Steelhead drainage in 2010; the harvest units containing the nest and nest buffer were subsequently removed from the unit pool. A probable nest site was documented in the Sal Creek area in 2012. The site is surrounded by approximately 40-year-old young growth and is within 50 feet of the beach (therefore within the beach buffer).

Subsistence

Introduction

Subsistence refers to the natural resources used by rural Alaskans. Under Section 803 of the Alaska National Interest Lands Conservation Act (ANILCA), subsistence is defined as: “the customary and traditional uses by Alaska residents of wild renewable resources for direct, personal, or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of non-edible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade.”

ANILCA provides for “the continuation of the opportunity for subsistence users by rural residents of Alaska, including both Natives and non-Natives, on the public lands.” It also states that “customary and traditional” subsistence uses of renewable resources “shall be the priority consumptive use of all such resources on the public lands of Alaska.”

Subsistence hunting, fishing, trapping, and gathering activities are a major focus of life for many residents on Prince of Wales Island. Reasons given for the participation in subsistence activities include the ability to provide food or supplemental income; the perpetuation of cultural customs and traditions; and the importance of values associated with self-reliance (USDA Forest Service 2008b).

The effects of landscape changes caused by timber harvest on the availability of wild game are important when the harvest of wild game is a cultural practice, food source, and recreational activity. Timber harvest may influence the abundance and distribution of subsistence resources (through changes in suitable habitat), access to subsistence resources (through changes in habitat and through road development or management), and competition for subsistence resources (through changes in abundance or access). ANILCA requires that the analysis of potential effects on subsistence uses focus on these factors. These factors are discussed below in the context of the Big Thorne Project. For a full discussion, see the Wildlife and Subsistence Resource Report (Woeck 2013a).

Small OGR modifications, proposed under Alternatives 3 and 4, would affect the amount of deer winter habitat and roads used for access within the reserve system, and thus have the potential to affect the abundance and distribution of, access to, and competition for deer depending on whether or not these areas are available for harvest. The existing small

OGRs in the project area include 3,213 acres of deep snow deer winter habitat (high-volume POG below 800 feet elevation) and 51 miles of road (Table OGR-2).

Abundance and Distribution of Resources

Subsistence resources in the vicinity of the Big Thorne Project include terrestrial mammals (deer, wolves, black bears, furbearers, and small game), upland birds and waterfowl, marine mammals, salmon and other fin fish, marine invertebrates, plants, firewood, berries, bark, and firewood. The terrestrial mammals (see discussions above under the appropriate species subheadings) occur throughout the project area year round. Spruce grouse (see discussion above) and ptarmigan occur throughout the project area year round; waterfowl occur in the project area during spring and fall migration and primarily on lakes and in bays and estuaries. Marine mammals, such as seals, occur in the marine waters adjacent to the project area. Streams and lakes within the Big Thorne project area provide habitat and contribute to the production of fish that support the local subsistence, sport, guided (both freshwater and saltwater), and commercial fisheries of the area. Eagle Creek, Luck Creek, Ratz Creek, Sal Creek, Slide Creek, and the Thorne River are known subsistence systems (USDA Forest Service 2008b). Subsistence plants, which include kelp, seaweed, goose tongue, mushrooms, and berries, occur along roads, previous harvested areas (berries), and near beach and estuarine areas.

Access to Resources

Road networks connecting local communities provide access to subsistence resources in the Big Thorne project area. Road building associated with timber harvest can provide access to previously inaccessible areas, providing greater opportunities for subsistence harvest; disperse hunting and fishing pressure; and create the potential for increased competition. On Prince of Wales Island, road construction has the potential to result in increased competition from outside communities by providing greater access to non-resident hunters (USDA Forest Service 2008b). Changes in access can affect the level of effort required, time involved, and the effectiveness of the hunt, as well as potentially increase competition for subsistence resources (if associated with increased hunter success; USDA Forest Service 2009d). The existing road network is described in the Transportation section of the EIS. Road closures in the project area are planned under the Prince of Wales Access and Travel Management Plan (see the Transportation section for details); the road closures in the POW ATM would reduce access to some areas.

Competition for Resources

Competition for subsistence resources may occur when resources are abundant and access is available to local and non-local users. Competition can also occur between different subsistence user groups and between subsistence hunters and sport hunters. The existing road system in the project area has created relatively large areas that are easily accessed from local communities. The existing road system is described in Table TRAN-3. The ferry systems allow relatively easy access from off-island communities. Non-subsistence hunters make up about 15 percent of the total hunters utilizing WAA 1318, 20 percent in WAA 1319, 35 percent in WAA 1420, and 37 percent in WAA 1315 (Forest Service 2008b). Under ANILCA, in times of resource scarcity or when demand exceeds biologically sound harvest levels, subsistence harvests have priority over other consumptive use of resources.

Subsistence Communities

There are multiple communities that either currently or have historically used the project area for subsistence use. These include Coffman Cove, Craig, Hollis, Hydaburg, Kasaan, Klawock, Metlakatla, Meyers Chuck, Naukati Bay, Petersburg, Point Baker, Port Protection, Thorne Bay, Whale Pass, and Wrangell (USDA Forest Service 2008b). There are records of subsistence use of the Project area by other communities (i.e., Haines, Kake, and Sitka), but levels of use are generally low; in addition, use by Ketchikan residents does occur within the Project area but Ketchikan does not qualify as a Federal subsistence community. Therefore, these communities have not been included in this assessment. A detailed description of each community is provided in the Wildlife and Subsistence Resources Report (Woeck 2013a).

These communities harvest a variety of resources from the project area, including salmon, other finfish, marine invertebrates, bear and deer; plants, firewood, berries, and bark are also harvested. However, deer are the primary subsistence resource that would be affected by timber harvesting activities and therefore the focus of this discussion (USDA Forest Service 2008b). The Wildlife and Subsistence resource report and Fisheries resource report provide additional information on other subsistence uses by community. Table WLD-12 lists the number of deer harvested in the project area WAAs by community. Note that some communities are known to hunt in the project area, but data regarding which WAA utilized or the exact numbers of deer taken are not available (e.g., Hollis, Hydaburg, Point Baker, and Whale Pass).

Table WLD-12. Total Deer Harvested and Annual Average Reported for Communities using the Project Area WAAs between 1996 and 2003

Community	Wildlife Analysis Areas (WAA)[1/, 2/]			
	1315	1318	1319	1420
Coffman Cove	26 (4)	-	5 (1)	607 (87)
Craig	240 (34)	806 (115)	261 (37)	175 (25)
Hollis	UNK	UNK	UNK	UNK
Hydaburg	UNK	UNK	UNK	UNK
Kasaan	26 (4)	-	-	-
Klawock	76 (11)	510 (73)	71 (10)	99 (14)
Metlakatla[3/]	-	-	-	-
Meyers Chuck	8 (1)	7 (1)	12 (2)	-
Naukati Bay	-	-	9 (1)	6 (1)
Petersburg	8 (1)	4 (1)	4 (1)	25 (4)
Point Baker	UNK	UNK	UNK	UNK
Port Protection	2 (<1)	-	-	-
Thorne Bay	802 (115)	57 (8)	863 (123)	128 (18)
Whale Pass	UNK	UNK	UNK	UNK
Wrangell	6 (1)	-	-	11 (2)

1/ Values in brackets indicated annual average between 1996 and 2003; data by WAA differentiating resident and non-resident harvest after 2003 are not available.
2/ "UNK" indicates communities that are known to subsistence hunt in the project area, but where hunting data are unknown. A dashed line indicates that a community is not known to subsistence hunt in a particular WAA.
3/ Uses adjacent WAA 1421
Data source: ADF&G 2006

Deer harvest and hunting efforts (i.e., number of deer taken) in GMU 2 generally increased from 1997 to 2000, and then declined from 2000 to 2004 (ADF&G 2006). Efforts increased again from 2004 to 2006, but remained steady between 2006 and 2007 (ADF&G 2007). Published data are not currently available for hunting efforts after 2007 for GMU 2 as a whole; however, based on unpublished data, there was a small increase in the total number of deer taken in the project area WAAs during 2008 and 2009 compared to the 2007 numbers (Bethune, ADF&G, personal comm. 2011). See the Deer subsection above for information on deer population trends within GMU 2.

Environmental Consequences

Biodiversity

Direct and Indirect Effects – All Alternatives

A functional and interconnected old-growth ecosystem is essential to maintaining various components of biodiversity, including structural complexity (within-stand and landscape level), connectivity (unfragmented, contiguous blocks of old growth), stand age and species composition, and various ecological processes (e.g., tree establishment, disturbance, and nitrogen fixation [USDA Forest Service 2008b]). Through the removal of POG, timber harvest would reduce biodiversity by shifting the age-structure of the forest (i.e., removed trees are replaced by younger generation cohorts; Franklin et al. 1997); changing the composition of understory vegetation (Deal and Tappeiner 2002); and removing key habitat features such as large decadent trees, snags, and downed logs. These changes may reduce the range of habitats that support diverse plants and animal communities and alter the ecological processes supported by the old-growth ecosystem. The amount of POG and its distribution across the landscape provide a measure of the direct effects of the project on biodiversity.

Indirectly, timber harvest and associated activities would fragment and reduce the quality of remaining habitats. Edge effects such as changes in vegetation structure, plant and wildlife species composition, predation rates, and disturbance may occur, with some effects extending up to 1,640 feet (500 meters) from the forest edge (see the Biodiversity affected environment discussion for additional detail). Fragmentation may remove linkages between habitat patches, making it harder for some wildlife to move across the landscape. A continuously distributed population could become a series of small, subpopulations that rely on the ability of dispersing individuals of genetic interchange and recolonization in the event of local extirpation. Remaining habitat patches would become smaller and less suitable for species associated with interior forest conditions. It can be assumed that the alternatives that harvest the most POG and result in the greatest increases in the number of POG patches on the landscape would result in the greatest edge effects and have the greatest adverse effects to biodiversity. All action alternatives would maintain at least 98 percent of the total, high-volume, and large-tree POG currently available in the North Central Prince of Wales biogeographic province (Tables WLD-13, WLD-14, and WLD-15).

Table WLD-13. Harvest of Total POG by Biogeographic Province, VCU, and Project Area for Each Alternative

Biogeographic Province/ VCU[1/, 2/]	1954 POG	2012 POG		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Original Acres	Existing Acres	% Original Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining
North Central Prince of Wales Island (14)	811,756	569,005	70	0	100	4,962	99	6,906	99	4,627	99	5,271	99
5720	7,569	3,869	51	0	100	0	100	0	100	0	100	0	100
5740	18,575	14,953	80	0	100	0	100	0	100	0	100	0	100
5750	11,543	11,141	97	0	100	0	100	236	98	0	100	0	100
5760	7,528	6,984	93	0	100	12	100	12	100	0	100	12	100
5780	4,946	3,688	75	0	100	561	85	570	85	474	87	499	86
5790	7,091	2,813	40	0	100	353	87	417	85	452	84	439	84
5800	9,767	7,036	72	0	100	322	95	698	90	397	94	408	94
5810	13,587	6,809	50	0	100	487	93	780	89	478	93	459	93
5820	2,470	2,461	100	0	100	15	99	175	93	0	100	99	96
5830	8,580	4,866	57	0	100	455	91	501	90	361	93	466	90
5840	9,941	5,826	59	0	100	571	90	787	86	550	91	618	89
5850	7,573	3,088	41	0	100	310	90	399	87	248	92	399	87
5860	13,998	6,323	45	0	100	306	95	528	92	271	96	338	95
5950	11,974	7,051	59	0	100	737	90	867	88	562	92	650	91
5960	5,785	5,590	97	0	100	64	99	64	99	31	99	60	99
5971	1,818	1,516	83	0	100	26	98	26	98	0	100	26	98
5972	13,090	8,584	66	0	100	742	91	846	90	802	91	799	91
5980	9,336	5,459	58	0	100	0	100	0	100	0	100	0	100
Project Area	148,249	98,654	67	0	100	4,962	95	6,906	93	4,627	95	5,271	95

1/ Includes NFS and non-NFS land

2/ Includes total VCU area, including portions extending outside the project area boundary.

Table WLD-14. Harvest of High-volume POG (SD 5S, 5N, 67) by Biogeographic Province, VCU, and Project Area for Each Alternative

	1954 POG	2012 POG		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Biogeo-graphic Province/ VCU[1/, 2/]	Acres	Existing Acres	% Original Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining
North Central Prince of Wales Island	400,378	248,324	62	0	100	2,621	99	3,859	98	2,612	99	2,752	99
5720	3,480	1,149	33	0	100	0	100	0	100	0	100	0	100
5740	7,821	5,503	70	0	100	0	100	0	100	0	100	0	100
5750	4,808	4,551	95	0	100	0	100	169	96	0	100	0	100
5760	3,687	3,338	91	0	100	5	100	5	100	0	100	5	100
5780	3,010	2,205	73	0	100	350	84	357	84	312	86	326	85
5790	3,673	934	25	0	100	205	78	243	74	267	71	254	73
5800	5,326	3,579	67	0	100	259	93	445	88	295	92	307	91
5810	8,128	3,790	47	0	100	390	90	585	85	380	90	363	90
5820	1,354	1,348	100	0	100	8	99	133	90	0	100	76	94
5830	4,492	2,115	47	0	100	249	88	259	88	205	90	249	88
5840	4,578	1,944	42	0	100	177	91	330	83	183	91	183	91
5850	3,506	635	18	0	100	71	89	99	84	31	95	85	87
5860	8,241	3,418	41	0	100	101	97	260	92	124	96	119	97
5950	6,638	3,546	53	0	100	468	87	594	83	352	90	433	88
5960	2,717	2,592	95	0	100	46	98	46	98	18	99	44	98
5971	1,180	987	84	0	100	7	99	7	99	0	100	7	99
5972	6,322	3,441	54	0	100	285	92	327	90	446	87	301	91
5980	5,101	2,640	52	0	100	0	100	0	100	0	100	0	100
Project Area	75,458	43,867	58	0	100	2,621	94	3,859	91	2,612	94	2,752	94

1/ Includes NFS and non-NFS lands.
2/ Includes total VCU area, including portions extending outside the project area boundary.

Table WLD-15. Harvest of Large Tree POG (SD 67) by Biogeographic Province, VCU, and Project Area for Each Alternative

Biogeographic Province/ VCU[1/, 2/]	1954 POG	2012 POG		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Acres	Existing Acres	%Original Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	% Existing Remaining	Acres Harvested	%Existing Remaining
North Central Prince of Wales Island	201,265	127,295	63	0	100	1,383	99	1,994	98	1,280	99	1,374	99
5720	2,049	824	40	0	100	0	100	0	100	0	100	0	100
5740	4,206	3,155	75	0	100	0	100	0	100	0	100	0	100
5750	2,354	2,237	95	0	100	0	100	39	98	0	100	0	100
5760	1,788	1,630	91	0	100	5	100	5	100	0	100	5	100
5780	2,004	1,640	82	0	100	282	83	288	82	259	84	267	84
5790	1,575	334	21	0	100	122	64	126	62	138	59	131	61
5800	2,177	1,385	64	0	100	142	90	180	87	115	92	113	92
5810	3,698	1,732	47	0	100	209	88	318	82	207	88	208	88
5820	966	963	100	0	100	93	90	105	89	0	100	73	92
5830	1,961	884	45	0	100	19	98	98	89	49	94	93	90
5840	1,750	557	32	0	100	15	97	131	77	22	96	22	96
5850	1,490	190	13	0	100	0	100	27	86	0	100	22	89
5860	3,991	1,410	35	0	100	410	71	78	94	8	99	5	100
5950	4,226	2,566	61	0	100	28	99	491	81	296	88	360	86
5960	1,557	1,499	96	0	100	27	98	28	98	0	100	26	98
5971	839	751	90	0	100	0	100	0	100	0	100	0	100
5972	2,574	1,257	49	0	100	58	95	82	93	187	85	48	96
5980	2,776	1,572	57	0	100	0	100	0	100	0	100	0	100
Project Area	37,099	22,116	60	0	100	1,383	94	1,994	91	1,280	94	1,374	94

1/ Includes NFS and non-NFS lands.
2/ Includes total VCU area, including portions extending outside the project area boundary.

The extent of these effects would depend in part on the amount of forest structure retained in harvested stands. Thus, effects to biodiversity would be expected to be lessened under uneven-aged and two-aged harvest prescriptions, which leave some portion of the trees standing in a unit. By contrast, even-aged harvest would result in marked periods in which habitat suitability and connectivity would change. For example, in the first 25 years following even-aged harvest (i.e., clear-cutting), harvested stands provide increased forage biomass, which provide a good source of forage during the summer for many wildlife species, but do not provide suitable winter habitat for species such as deer and marten. They also do not provide connectivity due to the reduction in overstory cover, required by many old-growth associated species. The even-aged young-growth stands that subsequently develop have little value to many wildlife species once the canopy closes and understory herbs and shrubs are shaded out. Unmanaged young-growth stands can remain in this condition up to 150 years before developing the characteristics of old-growth (USDA Forest Service 2008b). Alternatives that include the more uneven-aged harvest would be expected to maintain more biodiversity across the landscape than those that involve predominantly even-aged harvest.

Young-growth management could increase biodiversity in previously harvested stands. Thinning could extend the period that understory forage is available for species such as deer by delaying canopy closure, increase habitat for certain prey species, and promote conditions that mimic old-growth stand characteristics at a faster rate than would occur without treatment (USDA Forest Service 2000; Carey 2003). This would increase habitat suitability for old-growth associated species and improve landscape connectivity over the long-term. Enhanced structural diversity of commercially thinned stands may also promote wildlife species diversity, particularly for birds (Habar et al. 1996). However, research on the effectiveness of commercial thinning in providing these benefits is ongoing and peer-reviewed results are not yet available for all benefits (USDA Forest Service 2011b). Thus, the discussion of commercial thinning should be interpreted in the context of the remaining uncertainty associated with its benefits to biodiversity.

The system of OGRs and other non-development LUDs is intended to maintain the integrity of the old-growth ecosystem. Within the matrix, connectivity between reserves is maintained through Forest-wide standards and guidelines for stream buffers, the beach fringe, project-level legacy forest structure retention, and others that preclude or limit timber harvest in certain areas which would be implemented under all alternatives. Collectively, these measures would facilitate organism dispersal and maintain the functionality and interconnectedness of the old-growth ecosystem (USDA Forest Service 2008b). Effects of the small OGR modifications proposed under Alternatives 3 and 4 are described below and in detail in Issue 2.

Cumulative Effects – All Alternatives

The North Central Prince of Wales biogeographic province is the province on the Forest with the most extensive past and projected future harvest and development. The 2008 Forest Plan Final EIS projected the percent of original POG that would remain on all land ownerships (NFS and non-NFS) in 100+ years by biogeographic province assuming maximum future harvest (i.e., harvest of all acres in LUDs available for harvest; USDA Forest Service 2008b). Future developments on both NFS and non-NFS lands in the province were also taken into account (in the North Central Prince of Wales biogeographic province this includes the communities of Klawock, Craig, Thorne Bay, and many other small communities; USDA Forest Service 2008b). Assumptions for this analysis are included in the 2008 Forest Plan EIS (USDA Forest Service 2008b). In doing so, past, present, and reasonably foreseeable timber harvest projects, including the Big Thorne and others identified at the beginning of this chapter, were taken into account. Therefore, this approach provides an appropriate measure of cumulative harvest, and associated biodiversity effects within the biogeographic province, with the exception of any modifications to OGRs or land exchanges (see discussion under each alternative below).

Approximately 242,752 acres of POG have been harvested within the North Central Prince of Wales biogeographic province, including both NFS lands and non-NFS lands. The historic connectivity of the landscape has been compromised by prior timber harvest activities, resulting in a reduction to 70, 62, and 63 percent of the original total, high-volume, and large-tree POG in the biogeographic province. Based on the 2008 Forest Plan analysis, approximately 51 percent of the original (1954) POG would remain in this biogeographic province after full implementation of the Forest Plan and future non-NFS harvest in 100+

years (USDA Forest Service 2008b). This does not include maturing young-growth that develops older forest characteristics during that time period (estimated to be approximately 3-6 percent of the original POG that would be represented by mature second growth, in non-development LUDs, which would be beginning to take on older forest characteristics; USDA Forest Service 2008b). Future representation of high-volume POG and large-tree POG in this province is expected to be approximately 41 and 43 percent of the original amount, respectively, after 100+ years (USDA Forest Service 2008b).

Currently, the amount of original total POG within the project area VCUs ranges from 40 percent to 100 percent. All action alternatives would contribute to the cumulative reduction in POG in the project area VCUs as well as in the size and/or number of corridors (structural or functional) in the Big Thorne project area (Table WLD-16). Timber harvest on NFS, including micro-sales and Free Use, as well as on state lands would result in similar effects. Collectively, the Big Thorne Project in combination with ongoing and foreseeable projects would increase in the number of smaller patches on the landscape, reducing the amount of interior forest and increasing the occurrence of forest edge habitat. Edge effects such as shifts in species composition may reduce native biodiversity over time by favoring some species over others. Over time, commercial thinning proposed under Alternatives 3, 4, and 5, in combination with past and foreseeable young-growth thinning would increase biodiversity within the project area by promoting stand development.

All action alternatives, in combination with ongoing and foreseeable projects, would increase the number of project area VCUs in which the cumulative reduction in the amount of original (1954) total POG would be greater than 33 percent, determined in the Forest Plan to be the threshold at which matrix functions may be compromised (VCUs 5780 under all action alternatives, and VCU 5800 under Alterative 3; Table WLD-16). In project area VCUs where total original POG has already been reduced by more than 33 percent (and which are identified in the Forest Plan as requiring the Legacy standard and guideline), continued implementation of the Legacy standard and guideline would maintain the range of matrix functions. In these VCUs, increased habitat removal and fragmentation could locally hinder the movements of species with limited dispersal capabilities (e.g., Prince of Wales flying squirrel). Alternative 4 was specifically designed to minimize this effect by dropping units in areas identified as being important to connectivity and by proposing prescriptions and harvest methods that would have a lighter touch on the landscape, maintaining some value as habitat after harvest. For the remaining VCUs where cumulative POG reduction is less than 33 percent, all of the alternatives would be expected to maintain the full range of matrix functions and would not reduce the likelihood of populations persisting over time (Haufler 2006).

Although some wildlife species make more use of the larger forest types (i.e., total, high-volume, and large-tree POG) none of the wildlife species of concern discussed in this document are restricted to these habitats, with most species making some use of both POG and non-POG habitats (e.g., unproductive old-growth and older young-growth forests). The Forest Plan conservation strategy would continue to provide for extensive areas in reserves, distributed across the province. In addition, within matrix lands implementation of the Legacy Forest Structure and Riparian standards and guidelines under all alternatives, as well as the beach and estuary fringe, would maintain the functionality and interconnectedness of the old-growth ecosystem.

Table WLD-16. Cumulative POG Harvest by Alternative

Biogeographic Province/VCU[2/]	1954 POG (Acres)			Percent of Original (1954) POG Remaining[1/]														
				Alternative 1			Alternative 2			Alternative 3			Alternative 4			Alternative 5		
	All POG	High Volume POG	Large Tree POG	All POG	High Volume POG	Large Tree POG	All POG	High Volume POG	Large Tree POG	All POG	High Volume POG	Large Tree POG	All POG	High Volume POG	Large Tree POG	All POG	High Volume POG	Large Tree POG
North Central Prince of Wales Island[3/]	811,756	400,378	201,265	51	41	43	51	41	43	51	41	43	51	41	43	51	41	43
5720	7,569	3,480	2,049	50	32	40	50	32	40	50	32	40	50	32	40	50	32	40
5740	18,575	7,821	4,206	80	70	75	80	70	75	80	70	75	80	70	75	80	70	75
5750	11,543	4,808	2,354	97	95	95	97	95	95	94	91	93	97	95	95	97	95	95
5760	7,528	3,687	1,788	93	91	91	93	90	91	93	90	91	93	91	91	93	90	91
5780	4,946	3,010	2,004	75	73	82	63	62	68	63	61	67	65	63	69	64	62	68
5790	7,091	3,673	1,575	40	25	21	35	20	13	34	19	13	33	18	12	33	19	13
5800	9,767	5,326	2,177	72	67	64	69	62	57	65	59	55	68	62	58	68	61	58
5810	13,587	8,128	3,698	50	47	47	47	42	41	44	39	38	47	42	41	47	42	41
5820	2,470	1,354	966	100	100	100	99	99	100	93	90	89	100	100	100	96	94	92
5830	8,580	4,492	1,961	57	47	45	51	42	40	51	41	40	53	43	43	51	42	40
5840	9,941	4,578	1,750	59	42	32	53	39	31	51	35	24	53	38	31	52	38	31
5850	7,573	3,506	1,490	40	18	12	36	16	11	35	15	10	37	17	12	35	15	10
5860	13,998	8,241	3,991	39	36	31	37	35	31	35	33	29	37	35	30	37	35	30
5950	11,974	6,638	4,226	59	53	61	53	46	51	52	44	49	54	48	54	53	47	52
5960	5,785	2,717	1,557	97	95	96	96	94	94	96	94	94	96	95	96	96	94	95
5971	1,818	1,180	839	83	84	90	82	83	90	82	83	90	83	84	90	82	83	90
5972	13,090	6,322	2,574	66	54	49	60	50	47	59	49	46	59	47	42	59	50	47
5980	9,336	5,101	2,776	58	52	57	58	52	57	58	52	57	58	52	57	58	52	57
Project Area	148,249	75,458	37,099	66	58	59	63	54	55	61	52	54	63	54	56	62	54	55

1/ Includes NFS and non-NFS lands.
2/ Includes all VCUs that coincide with the project area boundary; no project activities proposed in VCUs 5720, 5740, 5971, or 5980 under any of the alternatives.
3/Percentages based on 2008 Forest Plan Final EIS analysis for the entire biogeographic province which projected impacts of Forest Plan implementation over 100+ years (USDA Forest Service 2008b); assumes all suitable lands are harvested, incorporating the Big Thorne Project.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects and negligible indirect effects to biodiversity because no action would be undertaken. The existing amount of total POG, high-volume POG, and large-tree POG would be maintained in the project area VCUs under Alternative 1 (Tables WLD-13, WLD-14, and WLD-15). Previously harvested stands would not be commercially thinned. They would continue to maintain stem exclusion characteristics over the majority of the planned harvest rotation unless treated under another project. The window for thinning these stands will be limited by stand growth responses to over-stocked conditions. This results in the development of low crown ratios and high height to diameter ratios which lead to reduced stand vigor as well as increased windthrow potential. These conditions reduce the ability to commercially thin effectively, which may limit the regeneration system to even-aged management when these stands are ready for final harvest.

Under Alternative 1, the level of fragmentation would remain unchanged, except for naturally occurring events (e.g., windthrow). If in the future treatment of young-growth stands is limited to even-aged management this could increase the long-term level of fragmentation compared to the use of uneven-aged system which would maintain some habitat value within treated stands.

Cumulative Effects

Under Alternative 1, the Big Thorne Project, in combination with past, ongoing, and foreseeable harvest, would maintain at least 39, 18, and 12 percent of the original (1954) total POG, high-volume POG, and large-tree POG, respectively, within project area VCUs (Table WLD-16). Alternative 1 would also result in a cumulative increase in the number of POG patches on the landscape of 6 percent (Table WLD-17). Ten VCUs, including eight with project activities, would maintain less than 67 percent of the original total POG (cumulative reduction of more than 33 percent; Table WLD-16). The movement capabilities of organisms with low mobility may be limited, potentially resulting in local gaps in distribution and a reduced likelihood of local population persistence, in the VCUs that have experienced habitat loss of more than 33 percent. The remaining VCUs would continue to have a high likelihood of maintaining habitat components important to a variety of species across the landscape. Cumulative reductions in POG, due to past harvest, under Alternative 1 were accounted for in the 2008 Forest Plan FEIS analysis, which concluded that with the conservation strategy in place full implementation of the Forest Plan would be expected to maintain viable, well-distributed populations across the North Central Prince of Wales biogeographic province.

Alternative 2

Direct and Indirect Effects

Alternative 2 would harvest 4,962 acres of POG including 2,621 acres of high-volume POG and 1,383 acres of large tree POG (Tables WLD-13, WLD-14, and WLD-15). Harvest under Alternative 2 would maintain at least 85 percent of the total POG, 76 percent of the high-volume POG, and 60 percent of the large-tree POG currently available in the project area VCUs (Tables WLD-13, WLD-14, and WLD-15). Approximately 77 percent of harvest would be even-aged harvest and 23 percent would be uneven-aged harvest, maintaining less biodiversity across the landscape than alternatives that include more uneven-aged harvest (e.g., Alternatives 4 and 5; Table TSE-4).

Generally, uneven-aged harvest is proposed in individual units that are widely distributed across the landscape (i.e., one unit near Luck Lake, one near Control Lake, etc.) and not located within travel corridors between areas of past harvest; thus, they would have more limited value in terms of maintaining the functional connectivity of the old-growth ecosystem. One exception is uneven-aged harvest proposed for a series of units (units 158, 159, and 161) south of Ratz Harbor which would maintain connectivity to the beach.

Effects of Alternative 2 to biodiversity associated with the removal of POG forest would be greatest in VCUs 5972, 5950, and 5840 where the most harvest is proposed. Reductions of 9, 10, and 10 percent of the existing POG would occur in these VCUs, respectively. All three VCUs coinciding with the project area that are currently considered intact landscapes (VCU 5750, 5820, and 5960; Table WLD-13) would remain so under Alternative 2.

Alternative 2 would also increase the number of POG patches on the landscape by 120 percent, thereby increasing fragmentation and associated edge effects and reducing connectivity. Alternative 2 would result in the second largest increase in number of patches in the smallest (0-25 acres) size class among the alternatives; fragmentation also alters the number of patches in other size categories including the number of large patches (Table WLD-17). Alternative 2 does not include commercial thinning of young growth, and therefore would not have the potential beneficial effects to biodiversity associated with promoting stand development in previously harvested stands (related effects would be the same as described under Alternative 1).

Cumulative Effects

Alternative 2, in combination with past timber harvest and ongoing and foreseeable projects, would maintain at least 35, 16, and 11 percent of the original total POG, high-volume POG, and large-tree POG, respectively, within project area VCUs (Table WLD-16). Alternative 2 would also result in a cumulative increase in the number of POG patches on the landscape of 126 percent (Table WLD-17). With the observed level of cumulative harvest, declines in biodiversity would be expected. Like Alternatives 4 and 5, 11 VCUs (including 9 with project activities) would maintain less than 67 percent of the original total POG (cumulative reduction of more than 33 percent) under Alternative 2 (Table WLD-16). Thus, Alternative 2 would result in two VCUs (in addition to those identified under Alternative 1) in which the movement capabilities of organisms with low mobility may be limited, potentially resulting in gaps in distribution and a reduced likelihood of local population persistence, due to habitat loss of more than 33 percent. The remaining VCUs would continue to have a high likelihood of maintaining habitat components important to a variety of species across the landscape. Cumulative reductions in POG under Alternative 2 were accounted for in the 2008 Forest Plan FEIS analysis, which concluded that with the conservation strategy in place, full implementation of the Forest Plan would be expected to maintain viable, well-distributed populations.

Table WLD-17. Number of POG Patches and POG acres within Patches by Size Class by Alternative for Direct and Cumulative Effects

Patch Size (acres)[1/]	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	No. Patches	Acres	No. Patches (% change)	Acres	No. Patches (% change)	Acres	No. Patches (% change)	Acres	No. Patches (% change)	Acres
Direct Effects										
0-25	308	2,827	838 (+172%)	3,653	923 (+200%)	3,756	716 (+132%)	3,350	811 (+163%)	3,529
26-100	96	4,135	108 (+13%)	5,384	109 (+14%)	5,497	105 (+9%)	5,153	107 (+11%)	5,268
101-500	35	5,538	36 +3%)	8,301	38 (+9%)	8,938	38 (+9%)	8,356	37 (+6%)	8,111
500-1000	7	3,676	6 (-14%)	4,457	7 (0%)	5,276	5 (-29%)	3,592	6 (-14%)	4,279
1000+[2/]	8	82,477	10 (+25%)	76,189	9 (+13%)	72,991	9 (+13%)	78,567	11 (+38%)	77,113
Total	**454**	**102,359**	**998 (+120%)**	**97,984**	**1,086 (+139%)**	**96,459**	**852 (+92%)**	**99,019**	**975 (+114%)**	**98,300**
Cumulative Effects										
0-25	332 (+8%)	3,127	863 (+180%)	3,741	950 (+208%)	3,866	740 (+140%)	3,438	836 (+171%)	3,617
26-100	101 (+5%)	4,856	113 (+18%)	5,514	113 (+18%)	5,559	110 (+15%)	5,283	112 (+17%)	5,399
101-500	36 (+3%)	7,184	37 (+6%)	8,307	39 (+11%)	8,944	39 (+11%)	8,362	38 (+9%)	8,117
500-1000	5 (-29%)	3,117	4 (-43%)	2,762	5 (-29%)	3,581	3 (-57%)	1,897	4 (-43%)	2,584
1000+[2/]	8 (+/-0%)	81,111	10 (+25%)	74,698	9 (+13%)	71,546	9 (+13)	77,073	11 (+38%)	75,621
Total	**482 (+6%)**	**99,394**	**1,027 (+126%)**	**95,021**	**1,116 (+146%)**	**93,496**	**901 (+98%)**	**96,054**	**1,001 (+120%)**	**95,337**

1/ Includes NFS and non-NFS lands; includes all patches intersecting the project area, some of which extend beyond the project area boundary.
2/ An increase in the number of 1000+ acre patches results from the fragmentation of a large patch where the resulting patches are still greater than 1,000 acres in size.

Alternative 3

Direct and Indirect Effects

Alternative 3 would harvest 6,906 acres of POG, the most under any alternative, including 3,859 acres of high-volume POG and 1,994 acres of large tree POG (Tables WLD-13, WLD-14, and WLD-15). Harvest under Alternative 3 would maintain at least 85 percent of the total POG, 74 percent of the high-volume POG, and 62 percent of the large-tree POG currently available in the project area VCUs (Tables WLD-13, WLD-14, and WLD-15). Approximately 69 percent of harvest would be even-aged harvest and 31 percent would be uneven-aged harvest, maintaining less biodiversity across the landscape than the other alternatives with more uneven-aged harvest and/or less overall harvest (Table TSE-4). The same units where uneven-aged harvest is proposed under Alternative 2 are also proposed for uneven-aged harvest under Alternative 3, and therefore would have the same effects from a connectivity standpoint as described above. However, Alternative 3 also includes uneven-aged harvest units north of Ratz Harbor and north of Sal Creek (coinciding with small OGR modifications) which would maintain some connectivity to the beach.

Effects of Alternative 3 to biodiversity would be greatest in VCUs 5950, 5972, and 5840 where the most harvest is proposed. Reductions of 12, 10, and 14 percent of the existing POG would occur in these VCUs, respectively. Of the three VCUs considered to be intact landscapes that coincide with the Big Thorne Project, one (VCU 5960) would remain intact under Alternative 3. The other two VCUs (5750 and 5820) may have a lower likelihood of maintaining a high degree of biodiversity but would likely remain functional because the amount of existing POG maintained is still over 90 percent.

Alternative 3 would increase the number of POG patches on the landscape by 139 percent, the most among the action alternatives, thereby increasing fragmentation and associated edge effects and reducing connectivity (Table WLD-17). Alternative 3 would result in the greatest increase in the smallest (0-25 acres) size class among the alternatives, and therefore would be expected to result in the greatest amount of edge effects among the alternatives. Alternative 3 would result in the fewest acres in the largest patch size class among the alternatives (Table WLD-17). Alternative 3 also involves the commercial thinning of 2,299 acres of young growth, and therefore would have the beneficial effects to biodiversity associated with opening the tree canopy and promoting understory development (Table TSE-4) in previously harvested stands.

Cumulative Effects

Alternative 3, in combination with past timber harvest and ongoing and foreseeable projects, would maintain at least 34, 15, and 10 percent of the original total POG, high-volume POG, and large-tree POG, respectively, within project area VCUs (Table WLD-16). Alternative 3 would also result in a cumulative increase in the number of POG patches on the landscape of 146 percent (Table WLD-17). With the observed levels of cumulative harvest, declines in biodiversity would be expected. Under Alternative 3, 12 VCUs (including 10 with project activities) would maintain less than 67 percent of the original total POG (cumulative reduction of more than 33 percent), the most among the action alternatives (Table WLD-16). The movement capabilities of organisms with low mobility may be limited, potentially resulting in gaps in distribution and a reduced likelihood of local population persistence, in the VCUs with habitat loss of more than 33 percent. The remaining VCUs would continue to have a high likelihood of maintaining habitat components important to a variety of species across the landscape.

Cumulative reductions in POG under Alternative 3 were accounted for in the 2008 Forest Plan FEIS analysis, which concluded that, with the conservation strategy in place, full implementation of the Forest Plan was expected to maintain viable, well-distributed populations across the North Central Prince of Wales biogeographic province. Changes in OGRs under Alternative 3, which affects the conservation strategy, is addressed under Issue 2 above.

Alternative 4

Direct and Indirect Effects

Alternative 4 would harvest 4,627 acres of POG, the least under any alternative, including 2,612 acres of high-volume POG and 1,280 acres of large tree POG (Tables WLD-13, WLD-14, and WLD-15). Approximately 27 percent of harvest would be even-aged harvest and 73 percent would be uneven-aged harvest, maintaining more biodiversity across the landscape than any of the action alternatives (Table TSE-4). Uneven-aged harvest under Alternative 4 includes more acres of harvest with 25 and 50 percent retention than any other alternative; it also includes two-aged harvest (Table TSE-4). These prescriptions would have a lighter touch on the landscape by maintaining more habitat value following harvest and focusing harvest on smaller areas (some as small as 1 acre) to maintain biodiversity and minimize wildlife impacts. Most uneven-aged harvest units under Alternative 4 are located in travel corridors between areas of past harvest (unit 194 north of Luck Lake; unit 183 northwest of Ratz Harbor; unit 177 north of Big Lake; units 158, 159, 162, 168 and 169 south of Ratz Creek/Big Lake; unit 145 south of Sal Creek; unit 121 along Gravelly Creek; unit 68 in the Gravelly Creek area; numerous units in the Phase 2 area [VCU 5780] where there is an area of concentrated past harvest near the Honker large OGR complex; and units 41, 42, 44, and 46 between the Honker Large OGR complex and the Karta Wilderness). Uneven-aged harvest of these units would maintain connectivity through these corridors.

Harvest under Alternative 4 would maintain at least 84 percent of the total POG, 71 percent of the high-volume POG, and 59 percent of the large-tree POG currently available in the project area VCUs (Tables WLD-13, WLD-14, and WLD-15). Effects of Alternative 4 to biodiversity would be greatest in VCUs 5972, 5950, and 5840 where the most harvest is proposed. Reductions of 9, 8, and 9 percent of the existing POG would occur in these VCUs, respectively. Of the three VCUs considered to be intact landscapes that coincide with the Big Thorne Project, all would remain intact under Alternative 4.

Alternative 4 would increase the number of POG patches on the landscape by 92 percent, thereby increasing fragmentation and associated edge effects and reducing connectivity; however, this increase is the least among the action alternatives (Table WLD-16). Alternative 4 would result in the smallest increase in the number of patches in the smallest size class and would maintain the most acreage in the largest patch size class among the action alternatives, and therefore would be expected to result in the fewest edge effects among the alternatives (Table WLD-17). Alternative 4 also involves the commercial thinning of 1,888 acres of young-growth, and therefore would have the beneficial effects to biodiversity associated with opening the tree canopy and promoting understory development (Table TSE-4).

Cumulative Effects

Alternative 4, in combination with past timber harvest and ongoing and foreseeable projects, would maintain at least 33, 17, and 12 percent of the original total POG, high-volume POG, and large-tree POG, respectively, within project area VCUs (Table WLD-16). Alternative 4 would also result in a cumulative increase in the number of POG patches on the landscape of 98 percent (Table WLD -17). With the observed levels of cumulative harvest, reductions in biodiversity would be expected. Like Alternatives 2 and 5, 11 VCUs, including 9 with project activities, would maintain less than 67 percent of the original total POG (cumulative reduction of more than 33 percent) under Alternative 4 (Table WLD-16). The movement capabilities of organisms with low mobility may be limited, potentially resulting in gaps in distribution and a reduced likelihood of local population persistence, in the VCUs with habitat loss of more than 33 percent. The remaining VCUs would continue to have a high likelihood of maintaining habitat components important to a variety of species the landscape.

Cumulative reductions in POG under Alternative 4 were accounted for in the 2008 Forest Plan FEIS analysis, which concluded that with the conservation strategy in place full implementation of the Forest Plan would be expected to maintain viable, well-distributed populations across the North Central Prince of Wales biogeographic province.

Alternative 5

Direct and Indirect Effects

Alternative 5 would harvest 5,271 acres of POG, including 2,752 acres of high-volume POG and 1,374 acres of large-tree POG (Tables WLD-13, WLD-14, and WLD-15). Harvest under Alternative 5 would maintain at least 84 percent of the total POG, 73 percent of the high-volume POG, and 61 percent of the large-tree POG currently available in the project area VCUs (Tables WLD-13, WLD-14, and WLD-15). Approximately 44 percent of harvest would be even-aged harvest and 55 percent would be uneven-aged harvest (Table TSE-4). Uneven-aged harvest units under Alternative 5 are also widely across the landscape and in most cases do not target travel corridors between areas of past harvest. Exceptions are units 158-161 and 167-169 south of Ratz Creek/Big Lake; unit 177 north of Big Lake; and unit 194 north of Luck Lake which would maintain connectivity through travel corridors.

Effects of Alternative 5 to biodiversity would be greatest in VCUs 5972, 5950, and 5840 where the most harvest is proposed. Reductions of 9, 9, and 11 percent of the existing POG would occur in these VCUs, respectively. Of the three VCUs considered to be intact landscapes that coincide with the Big Thorne Project, all would remain intact under Alternative 5.

Alternative 5 would increase the number of POG patches on the landscape by 114 percent, thereby increasing fragmentation and associated edge effects and reducing connectivity. The largest increase would occur in the smallest size class (0-25 acre; Table WLD-17). Alternative 5 would have the second highest amount of acreage in the largest patch size class among the action alternatives and therefore would be expected to result in the second least amount of edge effects among the alternatives (Table WLD-17). Alternative 5 also involves the commercial thinning of 1,850 acres of young growth, and therefore would have the benefits to biodiversity associated with opening the tree canopy and promoting understory development (Table TSE-4).

Cumulative Effects

Alternative 5, in combination with past timber harvest and ongoing and foreseeable projects, would maintain at least 33, 15, and 10 percent of the original total POG, high-volume POG, and large-tree POG, respectively, within project area VCUs (Table WLD-16). Alternative 5 would also result in a cumulative increase in the number of POG patches on the landscape of 120 percent (Table WLD-17). With the observed levels of cumulative harvest, reductions in biodiversity would be expected. Like Alternatives 2 and 4, 11 VCUs, including 9 with project activities, would maintain less than 67 percent of the original total POG (cumulative reduction of more than 33 percent) under Alternative 5 (Table WLD-16). The movement capabilities of organisms with low mobility may be limited, potentially resulting in gaps in distribution and a reduced likelihood of local population persistence, in the VCUs with habitat loss of more than 33 percent. The remaining VCUs would continue to have a high likelihood of maintaining habitat components important to a variety of species across the landscape. Cumulative reductions in POG under Alternative 5 were accounted for in the 2008 Forest Plan FEIS analysis, which concluded that with the conservation strategy in place full implementation of the Forest Plan would be expected to maintain viable, well-distributed populations across the North Central Prince of Wales biogeographic province.

Conclusion

All of the alternatives would reduce the amount of POG on the landscape and increase fragmentation. Based on the amount of POG harvest, amount of even-aged harvest, and increase in number of POG patches, effects to biodiversity would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1. All action alternatives increase the number of VCUs where cumulative harvest is greater than 33 percent of the original total POG (Table WLD-16). In these VCUs, additional habitat loss and fragmentation could locally hinder the mobility of species with low dispersal capabilities (e.g., Prince of Wales flying squirrel). Of the three intact VCUs, all would remain intact under Alternatives 2, 4, and 5.

Corridors

All of the action alternatives would result in timber harvest in the vicinity of the areas identified as being important as travel corridors or other areas important to connectivity. Alternative 4 was specifically designed to reduce this effect by dropping harvest units in these areas, or proposing uneven-aged and two-aged harvest prescriptions and logging methods that would retain biodiversity and habitat value. None of the alternatives would affect the corridors in the Cutthroat drainage, Control Creek drainage, and the Tributary to the North Thorne River near Thorne Lake, all of which are corridors associated with the Honker Divide, or in the Rio Roberts drainage.

The following provides a description of potential project impacts to travel corridors. The comparison of alternatives below is based on approximate acres of harvest within a corridor and proportion of harvest that is uneven-age. Uneven-aged prescriptions would maintain more forest structure within harvested stands and therefore assumed to maintain the functioning of the corridor more than even-aged harvest. The corridors described here do not have a defined width or length, as they represent a general area that animals might move through; therefore, the identification of units within a corridor per se was subjective. For this assessment, contiguous bands of old-growth forest within each corridor area were identified within which units were selected based on their proximity to the feature that appeared the most likely to function as a corridor (i.e., a drainage or other low elevation area) or in the case of the Honker Divide, along the edge of the large OGR. There are potentially additional units that may impact a corridor area as a whole, but the numbers presented here provide a relative means of comparing alternatives. Under all alternatives Forest Plan standards and guidelines for stream, beach, and estuary buffers as well as the for legacy forest structure would apply which would help to maintain connectivity outside of the reserve system.

Alternative 1

Direct, Indirect, and Cumulative Effects

§ **Honker Divide:** No harvest or road building would occur adjacent to the Honker Divide large-OGR complex under Alternative 1; therefore, the functional value of habitat along its eastern edges would be maintained. No commercial thinning in these areas would occur under Alternative 1; therefore, there would be no improvement in connectivity in these corridors over the long term.

- No activities are proposed in the Cutthroat drainage which is located within the Honker large OGR; therefore north-south connectivity in this corridor would be maintained.
- No activities are proposed in the Control Creek drainage; therefore, east-west connectivity between the Control Lake area and the Thorne River drainage would be maintained.
- No activities are proposed in the North Thorne drainage (east and west branch); therefore, north-south connectivity in this corridor would be maintained.
- No activities are proposed along the tributary to the Thorne River; therefore, north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage would be maintained.

§ **Rio Beaver Drainage:** There has been much past harvest along the Rio Beaver drainage (Figure WLD-1). There are three NEPA-cleared Control Lake timber sale units (mostly in roadless), totaling 150 acres, along the western edge of the corridor. The existing level of connectivity across the drainage would be maintained under Alternative 1 because no additional harvest or road building would occur in this drainage. No commercial thinning would occur under Alternative 1 in this drainage (included under Alternatives 3, 4, and 5); therefore, there would be no improvement in connectivity in this corridor over the long term.

§ **Rio Roberts Drainage**: No activities are proposed in this drainage under Alternative 1 because it is located within the Honker large OGR. Therefore the existing level of connectivity along this drainage would be maintained.

§ **Upper Steelhead Drainage:** No additional timber harvest or road building would occur in the Upper Steelhead drainage under Alternative 1. There are two NEPA-cleared Control Lake timber sale units (in roadless), totaling 25 acres, within the upper part of the corridor. Therefore, the existing level of east-west connectivity across the drainage would be maintained. No commercial thinning would occur under Alternative 1; therefore, there would be no improvement in connectivity in this corridor over the long term.

§ **Rush Peak Area:** No additional timber harvest or road building would occur in the Rush Peak area under Alternative 1. There are five NEPA-cleared Control Lake timber sale units (about half in roadless), totaling 61 acres, that occur along the edges of or in the two corridors. The existing level of north-south connectivity in this area would be maintained. The current small OGR in this VCU, which would be maintained under Alternative 1, is predominately high-elevation, high-gradient topography that provides a poor travel corridor. No commercial thinning would occur under Alternative 1; therefore, there would be no improvement in connectivity in this corridor over the long term.

§ **Control Lake Area:** No additional harvest or road building would occur in the Control Lake area under Alternative 1. Three NEPA-cleared Control Lake timber sale units (in roadless), totaling 84 acres, occur along the northern edge corridor.

Therefore, the existing level of connectivity between Control Lake and the Honker large OGR would be maintained under Alternative 1. No commercial thinning would occur under Alternative 1; therefore, there would be no improvement in connectivity in this corridor over the long term.

- **Ratz Harbor Area:** No additional timber harvest or road building would occur in the vicinity of Ratz Harbor under Alternative 1; therefore the existing level of east-west connectivity between the shoreline and interior forest would be maintained. However, because no commercial thinning would occur under Alternative 1, which is included under Alternatives 3, 4, and 5, there would be no improvement in functionality of this area as a travel corridor over the long-term.
- **Sal Creek Area:** There has been much past harvest along Sal Creek (VCU 5840; Figure WLD-1). The existing level of east-west connectivity would be maintained under Alternative 1 because no additional harvest or road building would occur in this drainage. However, because no commercial thinning would occur in this area under Alternative 1 (included under Alternatives 3, 4, and 5), there would be no improvement in connectivity in this corridor over the long term.
- **Clarence Strait Shoreline:** No additional harvest or road building would occur in areas adjacent to the Clarence Strait Shoreline under Alternative 1; therefore, the existing level of north-south connectivity would be maintained. No commercial thinning would occur under Alternative 1; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Snug Anchorage:** No additional harvest or road building would occur in the Snug Anchorage area under Alternative 1; therefore, the existing level of north-south connectivity between Sandy Beach and Thorne Bay would be maintained. No commercial thinning would occur under Alternative 1; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Luck Lake/Eagle Creek:** No additional harvest would occur in the Luck Lake/Eagle Creek area under Alternative 1; therefore, the existing level of connectivity between Luck Lake and the shoreline would be maintained. However, because no commercial thinning would occur in this corridor under Alternative 1 (included under Alternatives 3, 4, and 5), there would be no improvement in connectivity in this corridor over the long term.

Alternative 2

Direct, Indirect, and Cumulative Effects

There would be no changes to OGRs with Alternative 2, so no impacts on existing corridors would result from OGR changes.

- **Honker Divide:** Alternative 2 would harvest units adjacent to the Honker Divide large-OGR complex, but not within the Honker large OGR, and therefore has the potential to reduce the functional value of habitat along its eastern edge (Table WLD-18). However, because no commercial thinning would occur under Alternative 2 there would be no improvement in connectivity in these corridors over the long term.

- No activities are proposed in the Cutthroat drainage which is located within the Honker large OGR; therefore north-south connectivity in this corridor would be maintained.
- No activities are proposed in the Control Creek drainage; therefore, east-west connectivity between the Control Lake area and the Thorne River drainage would be maintained.
- Harvest includes approximately 182 acres along the west branch and 55 acres along the east branch of the North Thorne River, along the upper limits of the drainage, which would reduce this corridor. Effects to this corridor under Alternative 2 would be the second greatest among the action alternatives due to the level of proposed harvest, nearly all of which (83 percent) would be even-aged (Table WLD-18).
- No activities are proposed along the tributary to the Thorne River; therefore, north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage would be maintained.

§ **Rio Beaver Drainage:** Alternative 2 would harvest several units at the far northern and southern ends of the drainage. Effects under Alternative 2 would be comparable to Alternative 3 and greater than Alternatives 4 and 5, due to the amount of acreage and because less of the harvest (52 versus 86 percent) would be uneven-aged (Table WLD-18). There are also three NEPA-cleared Control Lake timber sale units (mostly in roadless), totaling 150 acres, along the western edge of the corridor. The drainage has been heavily harvested, and additional harvest would reduce some of the remaining connectivity across the drainage. There would be no improvement in connectivity along the drainage over the long-term under Alternative 2 because it does not involve the commercial thinning included under Alternatives 3, 4, and 5.

§ **Rio Roberts Drainage**: No activities are proposed in this drainage under Alternative 2 because it is located within the Honker large OGR. Therefore the existing level of connectivity along this drainage would be maintained.

§ **Upper Steelhead Drainage:** Alternative 2 would harvest the second greatest amount of acres in the Steelhead drainage, most of which (92 percent) would be even-aged, and therefore would have the second greatest effects among the action alternatives (Table WLD-18). There are also two NEPA-cleared Control Lake timber sale units (in roadless), totaling 25 acres, within the upper part of the corridor. Although some connectivity and wildlife habitat would be maintained by stream buffers, timber harvest, especially even-aged, would affect many of the remaining east-west connections across the drainage. No timber harvest or road building would occur on the branch of the drainage extending to Big Salt Lake; therefore connectivity to the Honker large OGR via this corridor would be maintained. No commercial thinning would occur under Alternative 2; therefore, there would be no improvement in connectivity in this corridor over the long term.

Table WLD-18. Comparison of Effects to Corridors with Project Effects by Alternative

Corridor	Alt 1		Alt 2		Alt 3		Alt 4		Alt 5		Ranking of Alternatives (Greatest to Least Effects)
	Acres	Uneven-aged Harvest	Acres	Uneven-aged Harvest	Acres	Uneven-aged Harvest	Acres	Uneven-aged or Two-aged Harvest	Acres	Uneven-aged Harvest	
Honker Divide Area	0	--	1,142	17%	1,540	24%	968 [2/]	98%	1,081	46%	3, 2, 5, 4, 1
Rio Beaver Drainage	0	--	155	52%	155	53%	170	86%	170	86%	3*/2, 5*/ 4*, 1
Upper Steelhead Drainage	0	--	643	8%	772	11%	481	36%	553	28%	3, 2, 5, 4, 1
Rush Peak Area	0	--	351	1%	454	13%	507	75%	355	22%	3, 4, 2, 5, 1
Control Lake Area	0	--	160	42%	160	42%	98	69%	156	43%	2/3, 5, 4, 1
Ratz Harbor Area	0	--	484	63%	484	63%	386	100%	448	91%	2/3*, 5*, 4*, 1
Sal Creek Area	0	-	165	67%	339	79%	193[2/]	100%	193	100%	3*, 5*/4*, 2, 1
Clarence Strait Shoreline	0	--	378	37%	797	67%	413	100%	521	91%	3, 5, 2, 4, 1
Snug Anchorage Area	0	--	107	0%	397	0%	17	0%	156	100%	3, 2/5, 4, 1
Luck Lake/Eagle Creek Area	0	--	306	33%	458	53%	288	90%	303	51%	3*, 2/5*, 4*, 1

'*' indicates commercial thinning would enhance connectivity over the long-term.

1/ Acres are approximate; the identification of harvest units within corridors is subjective as corridors do not have width or length dimensions.

2/ Includes approximately 229 acres of two-aged harvest along the fringes of the Honker Divide and approximately 30 acres of two-aged harvest in the Sal Creek area.

- **Rush Peak Area:** Alternative 2 would harvest units in the Rush Peak area along both the Rush Creek (approximately 157 acres) and Goose Creek (approximately 194 acres) drainages, the least among the action alternatives (Table WLD-18). Alternative 2 has the potential to reduce north-south connectivity in this area because nearly all harvest (99 percent) is even-aged. There are also five NEPA-cleared Control Lake timber sale units (about half in roadless), totaling 61 acres, that occur along the edges of or in the two corridors. No commercial thinning would occur under Alternative 2; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Control Lake Area:** Alternative 2 would harvest one unit east of Control Lake which is an area identified as being important for wolf movement between Control Lake and the Honker large OGR, and three units south of Control Lake. Effects under Alternative 2 would be comparable to Alternatives 3 and 5, which would harvest similar acreage with approximately the same proportion of uneven-aged prescriptions, and greater than Alternative 4 (Table WLD-18). There are also three Control Lake units (mostly in roadless), totaling 150 acres, along the western edge of the corridor. No commercial thinning would occur under Alternative 2; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Ratz Harbor Area:** Alternative 2 would harvest units in the Ratz Harbor area, both north and south of Big Lake, and therefore has the potential to reduce east-west connectivity to saltwater. Effects would be the same as Alternative 3, and greater than Alternatives 5 and 4 (Table WLD-18). However, some connectivity would be maintained by the existing small OGR which connects to the shoreline. Under Alternative 2, there would be no improvement in functionality of this area as a travel corridor over the long-term because no commercial thinning is proposed which is included under Alternatives 3, 4, and 5.
- **Sal Creek Area**: Alternative 2 would harvest two units south of Sal Creek which would reduce east-west connectivity to saltwater. Effects would be comparable to Alternatives 4 and 5, which would harvest slightly more acreage but all would be uneven-aged harvest, and less than Alternative 3 (Table WLD-18). Under Alternative 2 there would be no improvement in functionality of this area as a travel corridor over the long-term because no commercial thinning is proposed along Sal Creek which is included under Alternatives 3, 4, and 5.
- **Clarence Strait Shoreline**. Alternative 2 would harvest units adjacent to the shoreline, outside of the beach buffer, which would reduce north-south connectivity. However, a narrower corridor would be maintained. Effects would be less than Alternatives 3 and 5, and comparable to Alternative 4 because all harvest under alternative 4 would be uneven-aged (Table WLD-18). No commercial thinning would occur under Alternative 2; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Snug Anchorage**. Alternative 2 would reduce the northern end of this corridor though two harvest units near Sandy Beach; the rest of the corridor would be maintained. There are also approximately 120 acres of the North Thorne Bay and

Beach Road State timber sales that occur along the western boundary of the north-south corridor. Effects under Alternative 2 in this area would be less than Alternatives 3 and 5, and greater than Alternative 4 (Table WLD-18). The existing small OGR would continue to encompass a portion of this corridor. No commercial thinning would occur under Alternative 2; therefore, there would be no improvement in connectivity in this corridor over the long term.

§ **Luck Lake/Eagle Creek**: Under Alternative 2 the entire length of Eagle Creek, providing connectivity from Luck Lake to the shoreline, would be maintained in the existing small OGR. Harvest along Luck Creek (approximately 306 acres), a majority (68 percent) of which would be even-aged, would reduce this corridor extending south of Luck Lake. However, two other corridors along tributaries to Luck Creek to the small OGR in VCU 5810 and to Little Lake would be maintained. Effects under Alternative 2 would be comparable to Alternative 5, less than Alternative 3, and greater than Alternative 4, which involves more uneven-aged harvest (Table WLD-18). There would be no improvement in connectivity in this area over the long-term under Alternative 2 because it does not involve the commercial thinning included under Alternatives 3, 4, and 5.

Alternative 3

Direct, Indirect, and Cumulative Effects

§ **Honker Divide**: Alternative 3 would harvest the same units adjacent to the Honker Divide large-OGR complex as Alternative 2, plus additional adjacent units, some of which would become available through the proposed small OGR modification. Alternative 3 has the greatest potential among the alternatives to reduce the functional value of habitat along its eastern fringe, due to the level of harvest, nearly all of which (76 percent) would be even-aged (Table WLD-18). However, because no commercial thinning would occur in these areas under Alternative 3 there would be no improvement in connectivity in these corridors over the long term.

  § No activities are proposed in the Cutthroat drainage which is located within the Honker large OGR; therefore north-south connectivity in this corridor would be maintained.

  § No activities are proposed in the Control Creek drainage; therefore, east-west connectivity between the Control Lake area and the Thorne River drainage would be maintained.

  § Harvest includes acres along the western (approximately 182 acres) and eastern (approximately 198 acres) branches of the North Thorne drainage, the latter becoming available for harvest due to the small OGR modification. Alternative 3 would result in the greatest reductions to these corridors among the action alternatives.

  § No activities are proposed along the tributary to the Thorne River; therefore, north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage would be maintained.

- **Rio Beaver Drainage**: Alternative 3 would harvest units at the far northern and southern ends of the drainage. Effects would be the same as under Alternative 2, and greater than Alternatives 4 and 5 because more harvest would be even-aged (Table WLD-18). This drainage has been heavily harvested in the past and additional harvest would reduce some of the remaining connectivity across the drainage; however commercial thinning of previously harvested stands proposed under Alternative 3 would improve the functionality of the drainage as a travel corridor between the Karta Wilderness and Honker large OGR complex over the long-term.
- **Rio Roberts Drainage**: No activities are proposed in this drainage under Alternative 3 because it is located within the Honker large OGR. Therefore the existing level of connectivity along this drainage would be maintained.
- **Upper Steelhead Drainage**: Alternative 3 would have the greatest effect to connectivity in the Steelhead drainage among the action alternatives due to the level of harvest (Table WLD-18). There are also two NEPA-cleared Control Lake timber sale units (in roadless), totaling 25 acres, within the upper part of the corridor Reductions in the corridor along the west branch of the drainage would be the same as Alternative 2 (and greater than Alternatives 4 and 5). Alternative 3 also includes harvest along the east branch of the drainage which connects the Honker large OGR with Big Salt and which has experienced little past harvest; although existing connectivity to Big Salt is low due to state land selection south of the highway and other non-NFS land along the northern edge of Big Salt. No commercial thinning would occur in this area under Alternative 3; therefore, there would be no improvement in connectivity in this corridor over the long term. Small OGR modifications in this area would maintain the existing level of connectivity because they would not include this drainage.
- **Rush Peak Area**: Alternative 3 would harvest the second most acreage in the Rush Peak area among the action alternatives, including approximately 260 acres along the Rush Creek drainage and approximately 194 acres along the Goose Creek drainage (Table WLD-18). This has the greatest potential to reduce north-south connectivity. There are five NEPA-cleared Control Lake timber sale units (about half in roadless), totaling 61 acres, that occur along the edges of, or within, the two corridors. No commercial thinning would occur in this area under Alternative 3; therefore, there would be no improvement in connectivity in this corridor over the long term. Small OGR modifications under Alternative 3 would decrease the amount of low-elevation POG in the vicinity of Rush Peak.
- **Control Lake Area**: Under Alternative 3, effects in the Control Lake area would be the same as under Alternative 2, and greater than Alternatives 4 and 5 (see Alternative 2 for discussion).
- **Ratz Harbor Area**: Alternative 3 would harvest units in the Ratz Harbor area, both north and south of Big Lake, and therefore reducing the east-west connectivity to saltwater. Effects would be comparable to Alternative 2, and greater than Alternatives 4 and 5 (Table WLD-18). However, Alternative 3 also involves commercial thinning between Ratz Harbor and Trumpeter Lake and south

of Big Lake, which would improve the functionality of this area as a travel corridor over the long-term.

§ **Sal Creek Area**: Alternative 3 would harvest the greatest amount around Sal Creek among the alternatives. Harvest to the south of Sal Creek would be the same as under Alternatives 2, 4, and 5; Alternative 3 would also harvest units near the shoreline north of Sal Creek which would become available due to the proposed small OGR modification in VCU 5840 (Table WLD-18). This would reduce the connection between the North Thorne drainage and coastal habitats; however, a majority of this harvest (79 percent) would be uneven-aged. Commercial thinning along Sal Creek proposed under Alternative 3 would improve connectivity in this corridor over the long-term.

§ **Clarence Strait Shoreline:** Timber harvest, and thus reductions in connectivity, in this corridor would be greatest under Alternative 3 compared to the other alternatives (Table WLD-18). This would reduce north-south connectivity, though a narrower corridor would be maintained with the beach buffer. No commercial thinning would occur in this area under Alternative 3; therefore, there would be no improvement in connectivity in this corridor over the long term. Small OGR modifications in VCUs 5820 and 5830 would occur in this corridor but would have minor effects to connectivity because both the existing and proposed small OGRs include old-growth forest adjacent to the shoreline; small OGR modifications in VCU 5840 would reduce the inclusion of old-growth forest adjacent to the shoreline.

§ **Snug Anchorage Area:** Alternative 3 would harvest the most acreage in the Snug Anchorage area, resulting from the small OGR modification in VCU 5850 (Table WLD-18). There are also approximately 120 acres of the North Thorne Bay and Beach Road State timber sales that occur along the western boundary of the north-south corridor. Connectivity between Sandy Beach and Thorne Bay would be reduced by Alternative 3 because the narrowest part of the corridor and the portion around Sandy Beach would be harvested. No commercial thinning would occur in this area under Alternative 3; therefore, there would be no improvement in connectivity in this corridor over the long term.

§ **Luck Lake/Eagle Creek**: Alternative 3 is the only alternative that would result in harvest along the Eagle Creek drainage (approximately 82 acres) which would reduce the connectivity between Luck Lake and saltwater. This area would become available for harvest due to the small OGR modification in VCU 5810. However, a more narrow travel route would still exist in the Class I stream buffer on Eagle Creek which drains from Luck Lake to saltwater. Alternative 3 would also reduce the corridor along Luck Creek, but timber harvest (approximately 377 acres) would be comparable to the Alternatives 2 and 5 (Table WLD-18). Corridors along the tributaries to Luck Creek would be maintained. Commercial thinning around Luck Lake proposed under Alternative 3 would improve connectivity in this corridor over the long term.

Alternative 4

Direct, Indirect, and Cumulative Effects

- **Honker Divide**: Alternative 4 would harvest the least acreage adjacent to the Honker Divide large-OGR complex among the action alternatives, nearly all of which (98 percent) would be uneven-aged or two-aged (Table WLD-18). The approximately 229 acres of two-aged harvest would maintain connectivity by leaving unharvested areas. Therefore, Alternative 4 would have the least potential to reduce the functional value of habitat along its eastern fringe. No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in these corridors over the long term. Small OGR modifications proposed under Alternative 4 include the addition of acres to the western end of the existing small OGR in VCU 5790 (Gravelly Creek/Falls Creek; approximately 240 acres), providing a direct connection to the Honker Divide large OGR complex through VCU 5780. This would improve the biological functionality of the complex of small OGRs in VCUs 5790, 5800, and 5840.
  - No activities are proposed in the Cutthroat drainage which is located within the Honker large OGR; therefore north-south connectivity in this corridor would be maintained.
  - No activities are proposed in the Control Creek drainage; therefore, east-west connectivity between the Control Lake area and the Thorne River drainage would be maintained.
  - Harvest includes approximately 113 acres along the west branch and 55 acres along the east branch of the North Thorne drainage. Therefore, Alternative 4 would have the least potential to reduce connectivity along the drainage corridor. Effects to connectivity would be reduced under Alternative 4 by implementing uneven-aged harvest prescriptions with low (e.g., 25 percent) basal area removal.
  - No activities are proposed along the tributary to the Thorne River; therefore, north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage would be maintained.
- **Rio Beaver Drainage**: Effects to connectivity in the Rio Beaver drainage under Alternative 4 would the same as under Alternative 5, a majority of which (86 percent) uneven-aged (Table WLD-18). This is a greater amount of acreage under Alternatives 2 and 3, though these alternatives include more even-aged harvest. Commercial thinning proposed under Alternative 4 would improve the functionality of the drainage as a travel corridor between the Karta Wilderness and Honker large OGR complex over the long term.
- **Rio Roberts Drainage**: No activities are proposed in this drainage under Alternative 4 because it is located within the Honker large OGR. Therefore the existing level of connectivity along this drainage would be maintained.
- **Steelhead Drainage**: Effects to connectivity in the Steelhead drainage (east and west branch) would be least under Alternative 4 because units between previously harvested areas were dropped or unit shapes were modified to maintain east-west connectivity and other habitat value. Alternative 4 would harvest the least amount

of acreage among the action alternatives, though most of which (64 percent) would be even-aged. There are also two NEPA-cleared Control Lake units (in roadless), totaling 25 acres, within the upper part of the corridor. The small OGR modification under Alternative 4 in VCU 5950 would add OGR acreage encompassing a portion of the corridor along the west branch of the Steelhead drainage connecting to Big Salt Lake. No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in this corridor over the long term.

§ **Rush Peak Area**: Alternative 4 would harvest the most acreage in the Rush Peak area among the action alternatives; however, a majority (75 percent) would be uneven-aged (Table WLD-18). This includes approximately 170 acres along the Rush Creek drainage, most of which would become available due to the small OGR modification in VCU 5972, and approximately 336 acres along the Goose Creek drainage. There are also five NEPA-cleared Control Lake timber sale units (about half in roadless), totaling 61 acres, that occur along the edges of or in the two corridors. No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in this corridor over the long term due to forest management. However, Alternative 4 would relocate the existing small OGR to the east, surrounding Angel Lake, protecting the only low-elevation wildlife travel corridor leading along Goose Creek from the Honker Divide large OGR (through VCUs 5972 and 5980) to saltwater at Salt Chuck. Thus, under Alternative 4 connectivity in the vicinity of Rush Peak would improve.

§ **Control Lake Area**: Under Alternative 4 no harvest or road building is proposed between Control Lake and the Honker large OGR complex. Unit 27 was dropped from Alternative 4; although this unit, located northeast of Control Lake, was not expected to have much of an effect to wolf use of this corridor due to the presence of OGR and roadless acres that provide connectivity. There are also three NEPA-cleared Control Lake units (mostly in roadless), totaling 150 acres, along the western edge of the corridor. However, timber harvest southwest of Control Lake, which would be less than the other action alternatives, would reduce connectivity slightly between the Honker large OGR and the Steelhead drainage. No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in this corridor over the long term. This would be compensated for by the small OGR modifications proposed under Alternative 4, which include the addition of acres to the south of the existing small OGR (south of Control Lake), which would improve connectivity with the Honker large OGR complex, and encompass known areas of high wolf use in an area where there are already wolf mortality concerns.

§ **Ratz Harbor Area**: No timber harvest or road building would occur adjacent to Ratz Harbor under Alternative 4; however, timber harvest would affect the corridor north of Big Lake though all would be uneven-aged (Table WLD-18). Effects would be the least among the action alternatives. The small OGR modification in VCU 5830 would enhance this corridor through the addition of OGR acreage adjacent to Ratz Harbor (between Ratz Creek and the shoreline).

Additionally, commercial thinning between Trumpeter Lake and the shoreline and around Big Lake proposed under Alternative 4 would improve the functionality of this area as a travel corridor over the long-term.

§ **Sal Creek Area**: Effects to the corridor in the Sal Creek area under Alternative 4 would be comparable to Alternative 5, and more than Alternatives 2 and 3. Effects to connectivity would be reduced under Alternative 4 through the inclusion of approximately 30 acres of two-aged harvest in this corridor, which would retain some unharvested areas. Although harvest would reduce connectivity to the shoreline, the existing small OGR which includes old-growth forest north of Sal Creek maintains some connectivity between the North Thorne drainage and saltwater. Commercial thinning along Sal Creek proposed under Alternative 4 would improve connectivity in this corridor over the long term.

§ **Clarence Strait Shoreline**. Alternative 4 would harvest the second least amount of acreage near the Clarence Strait shoreline of the action alternatives, all of which would be uneven-aged (Table WLD-18). Though this would reduce north-south connectivity, a narrower corridor would be maintained. No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in this corridor over the long term. The small OGR in VCU 5820 occurs in this corridor and is maintained under Alternative 4; therefore, connectivity would be maintained because the existing small OGR includes old-growth forest adjacent to the shoreline.

§ **Snug Anchorage Area**. A minor amount of timber harvest (16 acres) would occur in the vicinity of Snug Anchorage under Alternative 4, the least among the action alternatives (Table WLD-18). No commercial thinning would occur in this area under Alternative 4; therefore, there would be no improvement in connectivity in this corridor over the long term due to forest management. Small OGR modifications in VCU 5850 would enhance this corridor through the addition of OGR acreage near Sandy Beach.

§ **Luck Lake/Eagle Creek**: Under Alternative 4 the entire length of Eagle Creek, providing connectivity from Luck Lake to the shoreline, would be maintained in the existing small OGR. Alternative 4 would harvest the least amount of acreage along Luck Creek among the action alternatives, a majority of which (90 percent) would be uneven-aged (Table WLD-18). Although this would reduce this corridor extending south of Luck Lake; two other corridors along tributaries to Luck Creek to the small OGR in VCU 5810 and to Little Lake would be maintained. Commercial thinning around Luck Lake proposed under Alternative 4 would improve connectivity in this corridor over the long term.

Alternative 5

Direct, Indirect, and Cumulative Effects

§ **Honker Divide**: Timber harvest adjacent to the Honker Divide large-OGR complex under Alternative 5 would be the second least among the action alternatives, 46 percent of which would be uneven-aged (Table WLD-18). No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in these corridors over the long term.

- No activities are proposed in the Cutthroat drainage which is located within the Honker large OGR; therefore, north-south connectivity in this corridor would be maintained.
- No activities are proposed in the Control Creek drainage; therefore, east-west connectivity between the Control Lake area and the Thorne River drainage would be maintained.
- Harvest includes approximately 95 acres of harvest along the west branch and 55 acres along the east branch of the North Thorne River, along the upper limits of the drainage, which would reduce this corridor. Effects to connectivity in this corridor under Alternative 5 would be the least among the action alternatives due to the level of proposed harvest, a majority of which (54 percent) would be even-aged (Table WLD-18).
- No activities are proposed along the tributary to the Thorne River; therefore, north-south connectivity from within the Honker large OGR to the west branch of the North Thorne Drainage would be maintained.

§ **Rio Beaver Drainage**: Timber harvest and associated reductions in connectivity in the Rio Beaver drainage under Alternative 5 would be similar to Alternative 4 (Table WLD-18). Commercial thinning proposed under Alternative 5 would improve the functionality of the drainage as a travel corridor between the Karta Wilderness and Honker large OGR complex over the long term.

§ **Rio Roberts Drainage**: No activities are proposed in this drainage under Alternative 5 because it is located within the Honker large OGR. Therefore the existing level of connectivity along this drainage would be maintained.

§ **Upper Steelhead Drainage**: Alternative 5 would result in the third greatest amount of timber harvest among the action alternatives in the Upper Steelhead drainage, most of which (72 percent) would be even-aged. This includes approximately 39 acres along the west branch of the Steelhead drainage, which connects the Honker large OGR with Big Salt Lake and which has experienced little past harvest, although existing connectivity to Big Salt is low due to state land selection south of the highway and other non-NFS land along the northern edge of Big Salt. There are also two NEPA-cleared Control Lake timber sale units (in roadless), totaling 25 acres, within the upper part of the corridor. Thus east-west and north-south connectivity through the drainage would be reduced. No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in this corridor over the long term.

§ **Rush Peak Area**: Effects of Alternative 5 in the Rush Peak area would be comparable to Alternative 2, but would include more uneven-aged harvest (Table WLD-18). No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in this corridor over the long term. The current small OGR in this VCU, described under Alternative 1, would also be maintained under Alternative 5.

- **Control Lake Area**: Effects of Alternative 5 in the Control Lake area would be comparable to Alternative 2 (Table WLD-18; see Alternative 2 for discussion). No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in this corridor over the long term.
- **Ratz Harbor Area**: Alternative 5 would result in less harvest than Alternatives 2 and 3 and more than Alternative 4, and therefore also has the potential to reduce east-west connectivity to saltwater (Table WLD-18). However, a majority of harvest (91 percent) would be uneven-aged. Some connectivity would be maintained by the existing small OGR in VCU 5830 which connects to the shoreline. Commercial thinning between Trumpeter Lake and the shoreline and around Big Lake under Alternative 5 would improve the functionality of this area as a travel corridor over the long-term.
- **Sal Creek Area**: Timber harvest in the Sal Creek area under Alternative 5 would be the same under Alternative 4 (Table WLD-18). However, commercial thinning along Sal Creek proposed under Alternative 5 would improve connectivity in this corridor over the long term.
- **Clarence Strait Shoreline:** Timber harvest near the Clarence Strait shoreline under Alternative 5 would be the second greatest among the action alternatives; however, nearly all the harvest (91 percent) would be uneven-aged harvest (Table WLD-18). No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in this corridor over the long term. Therefore, effect to connectivity along the shoreline would be slightly less than under Alternative 2.
- **Snug Anchorage Area:** Timber harvest in the Snug Anchorage area under Alternative 5 would be the same as under Alternative 2, with slightly more acres harvested but all of which would be uneven-aged (Table WLD-18). Thus, although the northern end of this corridor would be reduced by two harvest units near Sandy Beach, the rest of the corridor would be maintained. No commercial thinning would occur in this area under Alternative 5; therefore, there would be no improvement in connectivity in this corridor over the long term. The existing small OGR would continue to encompass a portion of this corridor.
- **Luck Lake/Eagle Creek**: Timber harvest in the vicinity of Luck Lake/Eagle Creek under Alternative 5 would be comparable to Alternative 2, but more than Alternative 4 and less than Alternative 3 (Table WLD-18). However, commercial thinning around Luck Lake proposed under Alternative 5 would improve connectivity in this corridor over the long term. Connectivity from Luck Lake to the shoreline would continue to be protected by the existing small OGR.

Conclusion

Alternative 3 has the greatest potential to adversely affect travel corridors or other areas that provide old-growth habitat connectivity, followed by Alternatives 2, 5, 4, and 1. Among the alternatives, Alternative 3 would result in the greatest amount of timber harvest within the corridors described above, and the small OGR modifications proposed under Alternative 3 would reduce connectivity (e.g., Rush Peak, Ratz Harbor, Sal Creek, and Luck Lake/Eagle Creek). Generally, less timber harvest would occur under Alternatives 2 and 5, and connectivity would be maintained by the existing small OGRs. The least amount of timber harvest within the corridors would occur under Alternative 4, and small OGR modifications proposed under Alternative 4 would maintain connectivity (e.g., Honker Divide, Rush Peak, Control Lake, and Ratz Harbor).

Management Indicator Species

Sitka Black-tailed Deer

Direct and Indirect Effects – All Alternatives

All of the alternatives would reduce deer habitat capability (Table WLD-19). Effects would be realized immediately after project completion (2014), but more so in 25 years (2040), as forest succession progresses and harvested stands reach the stem exclusion stage. Under all alternatives this would occur to some extent due to natural succession of previously harvested stands. Over the long-term, reductions in habitat capability could reduce carrying capacity, or the numbers of deer an area is capable of supporting given the available resources. This could lead to a decline in the deer population, particularly following severe winters, if the demand for resources (e.g., food or habitat) exceeds that which is available. Uneven-aged and two-aged harvest prescriptions would lessen reductions in habitat capabilities as both some cover and forage would be maintained in harvested stands. Declines in the deer population resulting from reduced habitat capability may decrease the availability of deer to wolves and hunters (Person 2001; Farmer et al. 2006; Brinkman et al. 2009). Likewise, reductions in deer habitat capability over the long-term may reduce the access to and availability of deer to subsistence hunters. Effects to wolves and subsistence resources are discussed below in the respective sections.

Table WLD-19. Relative Changes in Deer Habitat Capability (DHC) by WAA by Alternative for NFS Lands Only

WAA[1/]	1954 DHC[2/]	2013 DHC (%)	Deer Habitat Capability as Percent of 2013 and 1954 Values[3/, 4/]									
			Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
			at Project Completion	at Stem Exclusion	at Project Completion	at Stem Exclusion	at Project Completion	at Stem Exclusion	at Project Completion	at Stem Exclusion	at Project Completion	at Stem Exclusion
1315	2,403	59%										
% Reduction from Current (2013)			0%	-7%	-4%	-11%	-7%	-14%	-4%	-11%	-5%	-12%
% Historic (1954) Remaining			59%	55%	56%	53%	55%	51%	57%	53%	56%	52%
1318	1,271	92%										
% Reduction from Current (2013)			0%	-5%	-4%	-8%	-5%	-9%	-3%	-7%	-4%	-8%
% Historic (1954) Remaining			92%	88%	88%	85%	88%	84%	89%	86%	89%	85%
1319	3,325	76%										
% Reduction from Current (2013)			0%	-4%	-5%	-9%	-6%	-10%	-5%	-9%	-5%	-9%
% Historic (1954) Remaining			76%	73%	73%	70%	72%	69%	73%	79%	73%	70%
1420	1,392	55%										
% Reduction from Current (2013)			0%	-11%	-5%	-16%	-9%	-20%	-4%	-15%	-5%	-16%
% Historic (1954) Remaining			55%	49%	52%	46%	50%	44%	53%	47%	52%	46%

1/ WAAs 1316, 1421, and 1422 are slightly within the project area boundary, but no actions are proposed.
2/ Deer Habitat Capability (DHC), the theoretical number of deer capable of being supported.
3/ DHC calculated from the deer model for winter habitat. Habitat Suitability Indices (HSIs) were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest was calculated as even-aged; no predation was included. Source: GIS Database, deer_model.aml.
4/ Assumes harvest of all proposed units (project completion) occurs in 2014; assumes stem exclusion reached in 2040.

Timber harvest under all of the alternatives would decrease the amount of available average snow and deep snow winter habitat (Table WLD-20). This could alter the distribution of these habitats on the landscape resulting in concentrated deer use of these areas (Schoen et al. 1984), although they are already patchily distributed in the project area. Resident deer that concentrate use within remnant patches of low-elevation forested habitat may be more prone to increased predation pressure or may resort to using lower quality habitats (McNay and Voller 1995; B.C. Ministry of Forests 1996c). Such effects may indirectly affect the migratory deer population. Timber harvest would also increase foraging habitat over the short-term, but could also reduce overall the amount of non-winter habitat (through POG reduction). Loss of non-winter habitat could reduce the ability of deer to withstand harsh winter conditions if not enough forage is available for deer to build fat reserves.

Table WLD-20. Changes to Average Snow Winter Range, Deep Snow Winter Range, and Non-Winter Habitat for Deer by WAA by Alternative (NFS and Non-NFS Lands)

WAA	Habitat	1954 acres	2012 acres	Acres Impacted (% reduction from existing)				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	Deep Snow 1/	24,838	9,293	0	281 (3%)	581 (6%)	270 (3%)	317 (3%)
	Average Snow 2/	56,662	26,500	0	1,188 (5%)	1,698 (6%)	1,070 (4%)	1,355 (5%)
	Non-Winter 3/	96,780	66,004	0	1,222 (2%)	1,772 (3%)	1,120 (2%)	1,410 (2%)
1318	Deep Snow 1/	22,243	7,600	0	367 (5%)	439 (6%)	262 (4%)	320 (4%)
	Average Snow 2/	57,396	25,339	0	737 (3%)	867 (3%)	562 (2%)	650 (3%)
	Non-Winter 3/	123,442	89,474	0	751 (1%)	880 (1%)	573 (1%)	661 (1%)
1319	Deep Snow 1/	18,092	11,820	0	770 (7%)	928 (8%)	731 (6%)	795 (7%)
	Average Snow 2/	54,950	41,042	0	2,003 (5%)	2,781 (7%)	2,058 (5%)	2,149 (5%)
	Non-Winter 3/	102,637	88,400	0	2,162 (2%)	2,974 (3%)	2,210 (3%)	2,338 (3%)
1420	Deep Snow 1/	10,075	3,166	0	119 (4%)	410 (13%)	55 (2%)	181 (6%)
	Average Snow 2/	29,205	15,212	0	860 (6%)	1,360 (9%)	731 (5%)	932 (6%)
	Non-Winter 3/	46,187	31,988	0	984 (3%)	1,507 (5%)	870 (3%)	1,057 (3%)
Total	**Deep Snow 1/**	–	–	**0**	**1,537**	**2,358**	**1,319**	**1,613**
	Average Snow 2/	–	–	**0**	**4,787**	**6,706**	**4,421**	**5,085**
	Non-Winter 3/	–	–	**0**	**5,119**	**7,133**	**4,772**	**5,465**

1/ High volume POG (SD 5S, 5N, 6/7) at or below 800-foot elevation; GIS snow layer not applied.
2/ All POG (SD 4H, 4N, 4S, 5H, 5S, 5N, 6/7) at or below 1,500-foot elevation
3/ Spring/summer/fall habitat; all POG, non-productive old-growth, non-forested, muskeg, alpine habitats all elevations

Cumulative Effects – All Alternatives

Cumulative past harvest activities have reduced deer habitat capability to between 55 and 92 percent of the estimated capability in these WAAs in 1954 (Table WLD-21). Habitat capability would continue to be reduced as natural and harvest-associated windthrow occur and previously harvested stands reach the stem-exclusion stage. Additional harvest on NFS and state lands would further reduce deer habitat capability; microsales and free use have a negligible effect on deer habitat capability because they do not result in substantial stand modification.

Table WLD-21. Relative Changes Deer Habitat Capability (DHC) by WAA by Alternative for All Lands (NFS and Non-NFS Lands) Including Reasonably Foreseeable Projects

WAA[1/]	1954 DHC[2/]	2013 DHC (% 1954)	Deer Habitat Capability as Percent of 1954 Values (Additional Reduction)[3/, 4/, 5/]									
			Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
			At Project Completion	At Stem Exclusion	At Project Completion	At Stem Exclusion	At Project Completion	At Stem Exclusion	At Project Completion	At Stem Exclusion	At Project Completion	At Stem Exclusion
1315[4/]	2,403	59%	59% (0%)	55% (-4%)	56% (-3%)	53% (-6%)	55% (-4%)	51% (-8%)	57% (-2%)	53% (-6%)	56% (-3%)	52% (-7%)
1318	1,271	92%	92% (-<1%)	88% (-4%)	89% (-3%)	85% (-7%)	88% (-5%)	84% (-8%)	89% (-3%)	86% (-7%)	89% (-4%)	85% (-7%)
1319	3,325	76%	76% (-<1%)	73% (-3%)	73% (-4%)	70% (-7%)	72% (-5%)	69% (-8%)	73% (-4%)	70% (-7%)	73% (-4%)	70% (-7%)
1420	1,392	55%	54% (-<1%)	48% (-6%)	52% (-2%)	46% (-9%)	49% (-5%)	43% (-11%)	52% (-2%)	45% (-9%)	51% (-3%)	45% (-9%)

1/ WAAs 1316, 1421, and 1422 are within the project area boundary, but no actions are proposed.
2/ Deer Habitat Capability (DHC), the theoretical number of deer capable of being supported.
3/ DHC calculated from the deer model for winter habitat at all elevations. Habitat Suitability Indices (HSIs) were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest was calculated as even-aged; no predation was included. Source: GIS Database, deer_model.aml.
4/ Assumes harvest of all proposed units (project completion) occurs in 2014; assumes stem exclusion reached in 2040.
5/ Assumes all non-NFS lands are harvested.

Average snow, deep snow, and non-winter habitat have also been reduced by past harvest and would be further reduced from historic condition by all action alternatives. Cumulative reductions in deep snow and average snow winter habitat would be greatest in WAA 1315 and 1319 under all action alternatives (Table WLD-22). No other projects proposed small OGR modifications; therefore, there would be no additional change in the amount of deer winter habitat or low-elevation POG, representative of travel corridors for deer, included in the reserve system.

Table WLD-22. Cumulative Effects to Average Snow Winter Habitat, Deep Snow Winter Habitat, and Non-Winter Habitat for Deer by WAA and by Alternative on all Lands (NFS and Non-NFS Lands) Including Reasonably Foreseeable Projects

WAA	Habitat	Original (1954) acres	2012 (Percent Original Remaining)	Percent Original Habitat Remaining (Additional Reduction)[4/, 5/]				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	Deep Snow [1/]	24,838	37	35 (-2%)	34 (-3%)	33 (-5%)	34 (-3%)	34 (-3%)
	Average Snow [2/]	56,662	47	45 (-2%)	43 (-4%)	42 (-5%)	43 (-4%)	43 (-4%)
	Non-Winter [3/]	96,780	68	67 (-1%)	66 (-2%)	65 (-3%)	66 (-2%)	66 (-3%)
1318	Deep Snow [1/]	22,243	34	34 (0%)	33 (-2%)	32 (-2%)	33 (-1%)	33 (-1%)
	Average Snow [2/]	57,396	44	44 (0%)	43 (-1%)	43 (-2%)	43 (-1%)	43 (-1%)
	Non-Winter [3/]	123,442	72	72 (0%)	72 (-1%)	72 (-1%)	72 (-<1%)	72 (-1%)
1319	Deep Snow [1/]	18,092	65	65 (0%)	61 (-4%)	60 (-5%)	61 (-4%)	61 (-4%)
	Average Snow [2/]	54,950	75	75 (0%)	71 (-4%)	70 (-5%)	71 (-4%)	71 (-4%)
	Non-Winter [3/]	102,637	86	86 (0%)	84 (-2%)	83 (-3%)	84 (-2%)	84 (-2%)
1420	Deep Snow [1/]	10,075	31	31 (-<1%)	30 (-1%)	27 (-4%)	31 (-1%)	29 (-2%)
	Average Snow [2/]	29,205	52	52 (-<1%)	49 (-3%)	47 (-5%)	49 (-3%)	48 (-4%)
	Non-Winter [3/]	46,187	69	69 (-<1%)	67 (-2%)	66 (-4%)	67 (-2%)	67 (-3%)

1/ High volume POG (SD 5S, 5N, 6/7) at or below 800 ft elevation; GIS snow layer not applied.
2/ All POG (SD 4H, 4N, 4S, 5H, 5S, 5N, 6/7) at or below 1,500 ft elevation
3/ Spring/summer/fall habitat; all POG, non-productive old-growth, non-forested, muskeg, alpine habitats
4/ WAA 1315 incorporates reasonably foreseeable harvest on state lands and misc. National Forest harvest; WAA 1318 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); WAA 1319 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); and WAA 1420 incorporates reasonably foreseeable harvest on state lands and miscellaneous National Forest harvest.
5/ Percent change and percent reduction may not match exactly due to rounding

There is an inherent level of climate variability in the Pacific Northwest associated with Pacific Decadal Oscillation (PDO), or the shift between two different circulation patterns that occurs every 20 to 30 years in the North Pacific Ocean. Shifts in the location of cold and warm water in the Pacific alter the path of the jet stream, and thus result in long-term changes in weather patterns typified by "warm" and "cold" phases. It has been suggested that Southeast Alaska is in the early to middle cycle of a cold phase, marked by greater precipitation and cooler temperatures (D'Aleo and Easterbrook 2011). Thus, much past harvest (1980s and 1990s) occurred during a warm phase and therefore effects to the deer population may not be fully realized. Additionally, based on the past PDO cycles, it could mean another fifteen years or more with generally colder winters (D'Aleo and Easterbrook 2011). Having more extreme cold winters over a prolonged period of several years could lead to higher winter mortality rates for deer (Baichtal 2012). Therefore, long-term climate patterns may also contribute to cumulative effects to deer. However, there are many uncertainties related to how PDO works and how it might best be monitored, modeled, and predicted. Ultimately, the Forest Plan Conservation Strategy is intended to maintain the persistence the old-growth ecosystem (and the predator-prey dynamic of wolves and deer which it supports) under the unpredictable effects of climate (USDA Forest Service 2008b).

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects to deer habitat capability or to average snow, deep snow, or non-winter habitat because no action would be undertaken (current conditions are presented in Table WLD-20). Alternative 1 would result in an immediate reduction in deer habitat capability by WAA, as some stands move into the stem exclusion stage between now and project implementation, less than 1 percent from current conditions under each alternative (Table WLD-19). At stem exclusion, deer habitat capability would be reduced by a total of 4 to 11 percent from current conditions, depending on the WAA (Table WLD-19). Under Alternative 1, 55 to 92 percent of the original habitat capability would remain after project implementation, and 49 to 88 percent would remain at stem exclusion, depending on the WAA (Table WLD-19).

No commercial thinning of young-growth stands would occur under Alternative 1; therefore, development of young-growth into a stand with old-growth forest characteristics would occur slowly over time.

No small OGR modifications are proposed under Alternative 1. Therefore there would be no associated effects to deer. The current small OGRs collectively contain 3,213 acres of deep snow deer winter range and 7,213 acres of low elevation POG, which is indicative of higher value habitat (See Table OGR-2 under Issue 2).

Cumulative Effects

Alternative 1 in combination with past, ongoing, and foreseeable projects would maintain 54 to 92 percent of the original (1954) deer habitat capability at project completion, and 48 to 88 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-21). Alternative 1 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 31 to 65 percent of original amounts; average snow winter habitat to 44 to 75 percent of original amounts; and non-winter habitat to 67 to 86 percent of original amounts depending on the WAA (Table WLD-22).

Alternative 1 would not contribute to the beneficial effects of commercial thinning; however, pre-commercial thinning would occur in the project area under the Tongass Pre-commercial thinning program which would improve deer habitat. However, reductions in deer habitat capability due to natural succession under Alternative 1 may result in local declines in the deer population over time.

Alternative 2

Direct and Indirect Effects

Alternative 2 would result in an immediate reduction in deer habitat capability by WAA ranging from 4 to 5 percent from current conditions, the second highest among the alternatives (comparable to Alternative 5; Table WLD-18). At stem exclusion, deer habitat capability would be reduced by 8 to 16 percent from current conditions, depending on the WAA (Table WLD-19). Under Alternative 2, 52 to 88 percent of the original habitat capability on NFS lands would remain after project implementation, and 46 to 85 percent would remain at stem exclusion, depending on the WAA (Table WLD-19).

Alternative 2 would result in the harvest of approximately 1,537 total acres of deep snow winter habitat (3 to 7 percent reduction from current conditions by WAA), 4,787 total acres of average snow winter habitat (3 to 6 percent reduction from current conditions by WAA), and 5,119 total acres of non-winter habitat (1 to 3 percent reduction from current conditions by WAA; Table WLD-20). A majority of the timber harvest in all WAAs would be even-aged under Alternative 2 (Table WLD-23). Reductions in habitat capability and the amount of habitat available under Alternative 2 would result in local reductions in the numbers of deer an area is capable of supporting given the available resources. No commercial thinning of young-growth stands would occur under Alternative 2; therefore, development of young-growth stands into a stand with old-growth characteristics would occur slowly over time.

Table WLD-23. Harvest by Prescription by WAA

WAA	Acres of Total Harvest														
	Alt 1			Alt 2			Alt 3			Alt 4			Alt 5		
	Even-aged Harvest	Uneven-aged Harvest	Commercial Thinning	Even-aged Harvest	Uneven-aged Harvest	Commercial Thinning	Even-aged Harvest	Uneven-aged Harvest	Commercial Thinning	Even-aged Harvest	Uneven-aged or Two-aged Harvest	Commercial Thinning	Even-aged Harvest	Uneven-aged Harvest	Commercial Thinning
1315	--	--	--	806 (66%)	416 (34%)	0	1,198 (68%)	574 (32%)	842	247 (22%)	872[1/] (78%)	674	479 (34%)	931 (66%)	639
1318	--	--	--	631 (84%)	120 (16%)	0	731 (83%)	149 (17%)	0	331 (58%)	242 42%)	0	436 (66%)	225 (34%)	0
1319	--	--	--	1,833 (85%)	330 (15%)	0	2,203 (74%)	762 (26%)	626	293 (13%)	1,908[1/] (87%)	494	1,127 (48%)	1,202 (52%)	479
1420	--	--	--	652 (66%)	333 (34%)	0	812 (54%)	691 (46%)	835	111 (21%)	755[1/] (79%)	724	417 (45%)	635 (55%)	694

1/ Includes two-aged harvest: 34 acres in WAA 1315, 235 acres in WAA 1319, and 58 acres in WAA 1420.

No small OGR modifications are proposed under Alternative 2. Therefore there would be no associated effects to deer. The current small OGRs contain 3,213 acres of deep snow deer winter range and 7,213 acres of low-elevation POG, which is indicative of higher value habitat (See Table OGR-2 under Issue 2).

Cumulative Effects

Under Alternative 2, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 52 to 89 percent of the original (1954) deer habitat capability at project completion, and 46 to 85 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-21). Alternative 2 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 30 to 61 percent of original amounts; average snow winter habitat to 43 to 71 percent of original amounts; and non-winter habitat to 66 to 84 percent of original amounts, depending on the WAA (Table WLD-22). Alternative 2 would not contribute to the beneficial effects of commercial thinning. However, deer habitat would be improved in the future through pre-commercial thinning projects implemented under the Tongass Pre-commercial Thinning program. Ultimately, reductions in deer habitat capability due to timber harvest and natural succession under Alternative 2 may result in local declines in the deer population.

Alternative 3

Direct and Indirect Effects

Alternative 3 would result in an immediate reduction in deer habitat capability by WAA ranging from 5 to 9 percent from current conditions, the most among the alternatives (Table WLD-19). At stem exclusion, deer habitat capability would be reduced by a total of 9 to 20 percent from current conditions, depending on the WAA (Table WLD-19). Under Alternative 3, 50 to 88 percent of the original habitat capability on NFS lands would remain after project implementation, and 44 to 84 percent would remain at stem exclusion, depending on the WAA (Table WLD-19).

Alternative 3 would result in the harvest of approximately 2,358 total acres of deep snow winter habitat (6 to 13 percent reduction from current conditions by WAA), 6,706 total acres of average snow winter habitat (3 to 9 percent reduction from current conditions by WAA), and 7,113 total acres of non-winter habitat (1 to 5 percent reduction from current conditions by WAA; Table WLD-20). A majority of harvest in all WAAs (54 to 83 percent) would be even-aged under Alternative 3 (Table WLD-23). Reductions in habitat capability and the amount of habitat available under Alternative 3 would result in local reductions in the numbers of deer an area is capable of supporting given the available resources. However, Alternative 3 would also result in the commercial thinning of 2,299 acres of young-growth, the most of any alternatives, which would enhance deer habitat.

With the exception of VCU 5820 (Baird Peak), small OGR modifications under Alternative 3 would reduce the amount of deep snow deer winter range (reduction of 1,321 acres) and low-elevation POG (reduction of 2,736 acres) contained in the reserve system (see Table OGR-2 under Issue 2). This would potentially make these areas available to timber harvest which would reduce habitat capability for deer.

Cumulative Effects

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 49 to 88 percent of the original (1954) deer habitat capability at project completion, and 43 to 84 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-21). The level of deer habitat capability maintained under Alternative 3 would be the least among the alternatives. Alternative 3 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 27 to 60 percent of original amounts; average snow winter habitat to 42 to 70 percent of original amounts; and non-winter habitat to 65 to 83 percent of original amounts, depending on the WAA (Table WLD-22).

Cumulative effects would be greatest under Alternative 3 relative to the other alternatives, though these effects would be mitigated to some extent by commercial thinning. It is thought that commercial thinning would contribute to similar benefits provided by pre-commercial thinning (up to 12,300 acres pre-commercial thinning are anticipated to occur in the project area WAAs over the next 10 years) in enhancing deer habitat (forage availability). However, ultimately reductions in winter habitat capability, due to the removal of deer winter habitat, as a result of past, ongoing, and foreseeable harvest activities, would locally reduce deer carrying capacity. Over the long term, these cumulative effects would likely result in a population decline, especially following severe winters. This could reduce the number of deer available to wolves and hunters (see discussion under Wolf and Subsistence subsections below).

Alternative 4

Direct and Indirect Effects

Alternative 4 was designed in part to minimize impacts to deer such as by harvesting less winter habitat, and maintaining more travel corridors. Some units originally proposed were removed from the unit pool, or were modified by dropping portions or adjusting the unit boundary, to avoid deer winter habitat and travel routes between areas of past harvest. The inclusion of small patch and strip cuts in the Phase 2 area (VCUs 5780 and 5971) and in some units on the edge of the Honker large OGR complex would create edge habitats that deer prefer in proximity to areas of cover through which deer can move.

Alternative 4 would result in an immediate reduction in deer habitat capability by WAA ranging from 3 to 5 percent from current conditions, the least among the action alternatives (Table WLD-19). At stem exclusion state, deer habitat capability would be reduced by a total of 7 to 15 percent from current conditions, depending on the WAA (Table WLD-19). Under Alternative 4, 53 to 89 percent of the original habitat capability on NFS lands would remain after project implementation, and 47 to 86 percent would remain at stem exclusion, depending on the WAA (Table WLD-19).

Alternative 4 would result in the harvest of approximately 1,319 total acres of deep snow winter habitat (2 to 6 percent reduction from current conditions by WAA), 4,421 total acres of average snow winter habitat (2 to 5 percent reduction from current conditions by WAA), and 4,772 total acres of non-winter habitat (1 to 3 percent reduction from current condition by WAA; Table WLD-20). A majority of harvest would be even-aged in WAA 1318 (79 percent), but a majority would be uneven-aged in WAAs 1315 (78 percent), 1319 (87 percent), and 1420 (79 percent) where the most harvest of winter habitat would occur (Table WLD-23). Reductions in habitat capability and the amount of habitat available under Alternative 4 would result in local reductions in the numbers of deer an area is capable of supporting given the available resources. However, Alternative 4 would also result in the commercial thinning of approximately 1,888 acres of previously harvested young-growth stands which would enhance deer habitat.

Small OGR modifications proposed under Alternative 4 would increase inclusion of deep snow winter habitat (1,019 acres) and/or low-elevation POG (2,684 acres) in all VCUs where modifications are proposed with the exception of VCU 5830 (Ratz Harbor; See Table OGR-2 under Issue 2). Collectively these modifications would reduce the amount of deer habitat available for harvest. Many of the modification would also include low-elevation travel corridors which could be used by deer.

Cumulative Effects

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 52 to 89 percent of the original (1954) deer habitat capability at project completion, and 45 to 86 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-21). Alternative 4 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 31 to 61 percent of original amounts; average snow winter habitat to 43 to 71 percent of original amounts; and non-winter habitat to 66 to 84 percent of original amounts, depending on the WAA (Table WLD-22).

Cumulative effects would be least under Alternative 4 relative to the other action alternatives, and would be mitigated to some extent by commercial thinning which would contribute to similar benefits provided by pre-commercial thinning conducted on NFS lands in enhancing deer habitat (i.e., increased forage availability; Hanley 2005). However, ultimately reductions in deer habitat capability due to timber harvest and natural succession under Alternative 4 may result in local declines in the deer population.

Alternative 5

Direct and Indirect Effects

Alternative 5 would result in an immediate reduction in deer habitat capability by WAA ranging from 4 to 5 percent from current conditions (Table WLD-19). At stem exclusion state, deer habitat capability would be reduced by a total of 8 to 16 percent from current conditions, depending on the WAA (Table WLD-19). Under Alternative 5, 52 to 89 percent of the original habitat capability on NFS lands would remain after project implementation, and 46 to 85 percent would remain at stem exclusion, depending on the WAA (Table WLD-19). Effects would be less than under Alternative 3 but comparable to Alternatives 2 and 4.

Alternative 5 would result in the harvest of approximately 1,613 total acres of deep snow winter habitat (3 to 7 percent reduction from current conditions by WAA), 5,085 total acres of average snow winter habitat (3 to 6 percent reduction from current conditions by WAA), and 5,465 total acres of non-winter habitat (1 to 3 percent reduction from current conditions by WAA; Table WLD-20). A majority of harvest in WAA 1318 (66 percent) would be even-aged under Alternative 5; whereas a majority of harvest would be uneven-aged in WAAs 1315 (66 percent), 1319 (52 percent), and 1420 (60 percent; Table WLD-23). Reductions in habitat capability and the amount of habitat available under Alternative 5 would result in local reductions in the numbers of deer an area is capable of supporting given the available resources. However, Alternative 5 would also result in the commercial thinning of 1,850 acres, the least of all alternatives, of previously harvested stands which would enhance deer habitat.

No small OGR modifications are proposed under Alternative 5. Therefore there would be no associated effects to deer. The current small OGRs contain 3,213 acres of deep snow deer winter range and 7,213 acres of low-elevation POG, which is indicative of higher value habitat (see Table OGR-2 under Issue 2).

Cumulative Effects

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 51 to 89 percent of the original (1954) deer habitat capability at project completion, and 45 to 85 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-21). Alternative 5 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 29 to 61 percent of original amounts; average snow winter habitat to 43 to 71 percent of original amounts; and non-winter habitat to 66 to 84 percent of original amounts, depending on the WAA (Table WLD-22).

Cumulative effects under Alternative 5 would be comparable to Alternative 2, less than Alternative 3, and greater than Alternative 4. However, they would be mitigated to some extent through commercial thinning which would contribute to the similar benefits provided by pre-commercial thinning in enhancing deer habitat (i.e., increased forage availability). Ultimately, reductions in deer habitat capability due to timber harvest and natural succession under Alternative 5 may result in local declines in the deer population.

Conclusion

Deer winter habitat capability would be reduced under all alternatives. The greatest impacts would occur under Alternative 3, followed by Alternatives 2, 5, 4, and 1. Deep snow winter, average snow winter, and non-winter habitat would also be reduced under all action alternatives, with effects being greatest under Alternative 3, followed by 5, 2, and 4. Alternative 4 would have the fewest effects to deer because it harvests the fewest acres of deer winter habitat, and because greater habitat functionality would be maintained in harvested stands due to the predominance of uneven-aged and two-aged harvest. A majority of harvest in WAAs 1319 and 1420 would be uneven-aged under Alternative 4 where the most harvest is proposed, which would maintain some of the functionality of this habitat. Alternatives 3, 4 and 5 all propose acres of commercial thinning which would mitigate to some extent the effects of timber harvest by enhancing deer habitat.

Small OGR modifications proposed under Alternative 3 would reduce inclusion of deer winter habitat and low-elevation POG (indicative of higher value habitat) in the reserve system, whereas, all proposed small OGR modifications under Alternative 4 would benefit deer by increasing the amount of winter habitat and low-elevation POG and travel corridors in the reserve system.

Reductions in habitat capability in combination with periodic severe winters may result in a local decline in the deer population, particularly given recent declines observed on Prince of Wales Island, which could limit the number of deer available to wolves and hunters. The 2008 Forest Plan Final EIS (USDA Forest Service 2008c) predicts that with full implementation of the Forest Plan, WAAs 1315, 1318, 1319, and 1420 will retain 47, 75, 64, and 40 percent of the historic (1954) habitat capability in 100+ years, respectively, on NFS lands. Predictions including non-NFS lands would likely be lower (USDA Forest Service 2008c). Regardless of the alternative chosen for the Big Thorne Project, management activities would retain habitat capability (taking only NFS lands into account) above these predicted levels in all WAAs at project completion and at stem exclusion (Table WLD-19).

Alexander Archipelago Wolf

Direct and Indirect Effects – All Alternatives

The Big Thorne Project has the potential to directly adversely affect wolves through activities that create noise or disturbance, which could result in the displacement of wolves. Although there are several known wolf dens within the project area, there are no known wolf dens within any of the proposed harvest units. For known den sites close to harvest units, the 1,200-foot Forest Plan den site buffer was applied and unit boundaries adjusted as necessary; therefore none of the alternatives would directly or indirectly impact known active wolf dens. A new den site was discovered in the summer of 2012; however, its location (and associated buffer) does not affect any proposed Big Thorne units.

Indirect effects of the Big Thorne Project include the reduction of the wolf prey base (deer) and increased human access along project roads, which could reduce the wolf population through increased hunting and trapping pressure. It is assumed that a decline in the deer population would likely result in a decline in the wolf population (USDA Forest Service 2008b). Resonating effects could include reductions in opportunities to hunt or trap wolves (see Subsistence section). Therefore, impacts to wolves are assessed in terms of the reduction in deer habitat capability (based on habitat capability model outputs in terms of deer density). Note that this density does not represent actual population numbers but represents the functioning of the predator-prey system dynamic. Model assumptions, based on recent direction provided by the Forest Service include:

- For the project-related direct and indirect effects analysis, deer habitat capability by WAA (including only NFS lands) was divided by the total square miles of NFS lands (all elevations included, but with acres above 1,500 feet elevation receiving a zero value) in the WAA.
- For the cumulative effects analysis, deer habitat capability from all land ownerships (NFS and non-NFS lands) was divided by the total square miles of all lands (all elevations included, but habitats on non-NFS land and land above 1,500 feet elevation receiving a zero value) in the WAA.

Timber harvest would decrease carrying capacity for deer over the long-term due to reductions in the amount of available winter range (Table WLD-24; see also discussion of effects to deer). Current deer habitat capabilities in the project area WAAs are below the Forest Plan guideline of 18 deer per square mile, and suggest the project would result in higher risk that there will be insufficient number of deer to sustain wolves and hunting (see existing modeled deer densities in Table WLD-24). That concern exists despite the limited availability of alternative prey. This is due in part to the fact that alternative prey may delay a decline in wolf numbers relative to deer potentially causing wolf predation to have greater impact on declining deer numbers. Deer model calculations show that there would be an estimated decline of approximately 0.6 to 1.3 deer per square mile in the project area WAAs from current levels due to natural forest succession (i.e., between current levels and the stem exclusions stage; Table WLD-24). Within the northern portion of Prince of Wales Island, the alternatives would reduce the existing deer habitat capability by 1 to 2 percent after project implementation and by 4 to 5 percent at stem exclusion (Table WLD-24). At the biogeographic province scale, deer habitat capability is currently 17.95 deer per square mile, decreasing to 17.70-17.77 deer per square mile, depending on alternative, at project completion (Alternative 1 decreases to 17.89) and to between 17.17 and 17.24 deer per square mile at stem exclusion for the action alternatives (Alternative 1 decreases to 17.36). Across the North Central Prince of Wales Island biogeographic province existing deer habitat capability would be reduced by 1 percent after project implementation and by 4 percent at stem exclusion (Table WLD-24).

Table WLD-24. Effects of Timber Harvest on Deer Density by WAA (NFS Lands Only)

WAA	Year	Density or %	Existing Conditions	Deer Habitat Capability, % Reduction from 2013 DHC, and % of 1954 DHC Remaining by Alternative [1/]				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	1954	deer/mi2	28.3	--	--	--	--	--
	2013	deer/mi2	16.7	--	--	--	--	--
		% of 1954	59%	--	--	--	--	--
	2014 after Implementation	deer/mi2	--	16.6	16.0	15.5	16.0	15.8
		% reduction from 2013	--	0%	-4%	-7%	-4%	-5%
		% of 1954		59%	56%	55%	57%	56%
	2040 at Stem Exclusion	deer/mi2	--	15.5	14.9	14.4	14.9	14.7
		% reduction from 2013	--	-7%	-11%	-14%	-11%	-12%
		% of 1954	--	55%	53%	51%	53%	52%
1318	1954	deer/mi2	14.7	--	--	--	--	--
	2013	deer/mi2	13.6	--	--	--	--	--
		% of 1954	92%	--	--	--	--	--
	2014 after Implementation	deer/mi2	--	13.5	13.0	12.9	13.1	13.0
		% reduction from 2013	--	0%	-4%	-5%	-3%	-4%
		% of 1954	--	92%	88%	88%	89%	89%
	2040 at Stem Exclusion	deer/mi2	--	12.9	12.4	12.3	12.5	12.5
		% reduction from 2013	--	-5%	-8%	-9%	-7%	-8%
		% of 1954	--	88%	85%	84%	86%	85%
1319	1954	deer/mi2	20.9	--	--	--	--	--
	2013	deer/mi2	16.0	--	--	--	--	--
		% of 1954	76%	--	--	--	--	--
	2014 after Implementation	deer/mi2	--	15.9	15.2	15.0	15.2	15.1
		% reduction from 2013	--	-1%	-5%	-6%	-5%	-5%
		% of 1954		76%	73%	72%	73%	73%
	2040 at Stem Exclusion	deer/mi2	--	15.3	14.6	14.4	14.6	14.6
		% reduction from 2013	--	-4%	-9%	-10%	-9%	-9%
		% of 1954	--	73%	70%	69%	70%	70%
1420	1954	deer/mi2	21.5	--	--	--	--	--
	2013	deer/mi2	11.8	--	--	--	--	--

Table WLD-24. Effects of Timber Harvest on Deer Density by WAA (NFS Lands Only) (cont.)

WAA	Year	Density or %	Existing Conditions	Deer Habitat Capability, % Reduction from 2013 DHC, and % of 1954 DHC Remaining by Alternative 1/				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1420 (cont.)	2013	% of 1954	55%	--	--	--	--	--
	2014 after Implementation	deer/mi2	--	11.8	11.3	10.8	11.3	11.2
	2014 after Implementation	% reduction from 2013	--	0%	-5%	-9%	-4%	-5%
		% of 1954	--	55%	52%	50%	53%	52%
	2040 at Stem Exclusion	deer/mi2	--	10.5	10.0	9.5	10.0	9.9
		% reduction from 2013	--	-11%	-16%	-20%	-15%	-16%
		% of 1954	--	49%	46%	44%	47%	46%
North Central Prince of Wales Biogeographic Province (all WAAs)	1954	deer/mi2	24.3					
	2013	deer/mi2	18.0					
		% of 1954	74%					
	2014 after Implementation	deer/mi2		17.9	17.8	17.7	17.8	17.8
		% reduction from 2013		-1%	-1%	-2%	-1%	-1%
		% of 1954		74%	73%	73%	73%	73%
	2040 at Stem Exclusion	deer/mi2		17.4	17.2	17.2	17.2	17.2
		% reduction from 2013		-4%	-4%	-5%	-4%	-4%
		% of 1954		71%	71%	71%	71%	71%
Northern Portion of Prince of Wales Island 2/	1954	deer/mi^2	22.4	--	--	--	--	--
	2013	deer/mi^2	17.0	--	--	--	--	--
		% of 1954	76%	--	--	--	--	--
	2014 after Implementation	deer/mi^2	--	17.0	16.8	16.8	16.8	16.8
		% reduction from 2013		0%	-1%	-2%	-1%	-1%
		% of 1954	--	76%	75%	75%	75%	75%
	2040 at Stem Exclusion	deer/mi^2	--	16.4	16.3	16.2	16.3	16.3
		% reduction from 2013		-4%	-5%	-5%	-4%	-5%
		% of 1954	--	73%	73%	72%	73%	73%

1/ Deer habitat capability calculated from the deer model for winter habitat (all elevations). Habitat Suitability Indices (HSIs) were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest was calculated as even-aged; no predation was included.
2/ Includes WAAs 1107, 1212, 1213, 1214, 1315, 1316, 1317, 1318, 1319, 1323, 1332, 1420, 1421, 1422, 1527, 1528, 1529, and 1530.
Source: Forest Service GIS Database, deer_model.aml

All action alternatives involve the construction of roads. The roads associated with timber harvest may also increase the risk of hunting and trapping related wolf mortality by increasing human access; however this should be examined in the context of the existing road system. New roads constructed in drainages with an extensive system of existing roads would be expected to have less of an effect on harvest-related mortality risk than new roads entering undisturbed areas which may provide new points of access for hunters and trappers. All proposed roads under the Big Thorne Project consist mainly of short segments with no new road connections. Such effects may be counteracted to some extent through additional road closures (Prince of Wales Island ATM); open roads would be expected to have a greater effect than roads that are closed (either through storage or decommissioning) following their use (Person and Russell 2008). However, Person and Logan (2012) modeled the effects of such closures and found them to have little influence on mortality risk. Under all action alternatives, system roads constructed for the project would be closed and stored in 1 to 5 years following timber sale activities; prior to that, the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30 (see Chapter 2 and the Transportation section for additional discussion of road classes).

Existing road densities in WAAs 1315, 1319, and 1420 exceed the 1.5 mile per square mile (0.9 km per square km) threshold suggested by Person and Russell beyond which they found road density to have little additional effect on harvest rates. However, the Forest Service acknowledges that concern over wolf mortality rates still exists where road densities are at or above 1.5 miles per square mile. Harvest rates would potentially increase in WAA 1318 because current total road densities are below this threshold; however, increases under all alternatives would be 0.2 mile per square mile or less (Table WLD-25). The effects of roads on wolf mortality risk may be exacerbated in WAAs that have beach access (WAAs 1420 and 1315) used by hunters and trappers. Road management issues within the project area WAAs, where wolf mortality concerns may exist, can be addressed in the ROD. (Note that for direct and indirect effects, road densities are calculated for NFS lands only below 1,200 feet, while for cumulative effects, road densities are calculated for NFS and non-NFS lands below 1,200 feet.)

Table WLD-25. Road Density below 1,200 feet Elevation on NFS Lands Only after Implementation of the Alternatives

Island/WAA	Road Status[2/, 3/]	Road Density by Alternative ($mile/mile^2$)[1/]				
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	Open	1.07	1.09	1.15	1.07	1.07
	Closed	1.06	1.15	1.18	1.07	1.07
	Total	2.14	2.25	2.33	2.14	2.14
1318	Open	0.49	0.50	0.50	0.49	0.49
	Closed	0.23	0.28	0.29	0.24	0.25
	Total	0.71	0.77	0.78	0.73	0.74
1319	Open	0.82	0.85	0.85	0.82	0.82
	Closed	0.78	0.85	0.87	0.79	0.82
	Total	1.60	1.70	1.72	1.61	1.65
1420	Open	1.40	1.41	1.42	1.40	1.40
	Closed	1.12	1.14	1.16	1.12	1.13
	Total	2.51	2.55	2.58	2.51	2.52
Prince of Wales Island[4/]	Open	0.53	0.54	0.54	0.53	0.53
	Closed	0.46	0.47	0.47	0.46	0.46
	Total	**0.99**	**1.01**	**1.01**	**0.99**	**1.00**

1/ Includes only NFS lands.
2/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads.
3/ Note - all proposed System roads are treated as open roads; however, they will be closed within 1-5 years after harvest (for 1 to 5 years following timber harvest activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30)
4/ Includes 18 Prince of Wales Island WAAs; does not include the adjacent island WAAs (e.g., Kosciusko, Heceta, Tuxekan, Dall, etc.). This is the spatial area within which Person and Logan (2012) documented a correlation between wolf harvest-mortality risk and road density.

The Forest Service continues to work on the wolf issues and information gaps originally identified during an interagency meeting held in October 2011. On March 26, 2013, Forest Supervisor Forrest Cole directed Brian Logan, Tongass NF biologist, to reconvene a meeting to discuss the Forest Service's commitment to work with ADF&G and USFWS on wolf issues of mutual interest.

Cumulative Effects – All Alternatives

Timber harvest that has occurred since 1954 has reduced habitat capability for deer through the removal of POG. All action alternatives result in an additional reduction of deer habitat capability, contributing to similar effects associated with ongoing and future timber harvest on NFS and lands in other ownership. Collectively this has the potential to result in localized declines in the deer population, and thus the prey base for wolves. At project completion (all alternatives), none of the project area WAAs (all land ownerships included) would support 18 deer per square mile, though none of them do currently (Table WLD-26). Wolves are highly mobile within their territories and nearby WAAs with higher deer densities (e.g., WAAs 1323 and 1332) would continue to support wolves in the vicinity of the project. Moreover, the intent of this guideline was to apply to a larger spatial scale (i.e., multiple WAAs or biogeographic province).

Table WLD-26. Cumulative Impacts to Deer Habitat Capability by WAA (NFS and Non-NFS Lands)

WAA	Year	Density or % of 1954	Existing	Deer Habitat Capability and % of 1954 DHC by Alternative [1/, 2/]				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	1954	$deer/mi^2$	15.9	--	--	--	--	--
	2013	$deer/mi^2$	9.4	--	--	--	--	--
		% of 1954	59%	--	--	--	--	--
	2014 after Implementation	$deer/mi^2$	--	9.4	9.0	8.7	9.0	8.9
		% of 1954	--	59%	56%	55%	57%	56%
	2040 at Stem Exclusion	$deer/mi^2$	--	8.8	8.4	8.1	8.4	8.3
		% of 1954	--	55%	53%	51%	53%	52%
1318	1954	$deer/mi^2$	6.6	--	--	--	--	--
	2013	$deer/mi^2$	6.1	--	--	--	--	--
		% of 1954	92%	--	--	--	--	--
	2014 after Implementation	$deer/mi^2$	--	6.1	5.9	5.8	5.9	5.9
		% of 1954	--	92%	89%	88%	89%	89%
	2040 at Stem Exclusion	$deer/mi^2$	--	5.8	5.6	5.5	5.6	5.6
		% of 1954	--	88%	85%	84%	86%	85%
1319	1954	$deer/mi^2$	20.7	--	--	--	--	--
	2013	$deer/mi^2$	15,8	--	--	--	--	--
		% of 1954	76%	--	--	--	--	--
	2014 after Implementation	$deer/mi^2$	--	15.7	15.0	14.8	15.1	15.0
		% of 1954	--	76%	73%	72%	73%	73%
	2040 at Stem Exclusion	$deer/mi^2$	--	15.1	14.4	14.2	14.4	14.4
		% of 1954	--	73%	70%	69%	70%	70%
1420	1954	$deer/mi^2$	19.4	--	--	--	--	--
	2013	$deer/mi^2$	10.5	--	--	--	--	--
		% of 1954	54%	--	--	--	--	--

Table WLD-26. Cumulative Impacts to Deer Habitat Capability by WAA (NFS and Non-NFS Lands) (cont.)

WAA	Year	Density or % of 1954	Existing	Deer Habitat Capability and % of 1954 DHC by Alternative 1/, 2/				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1420 (cont.)	2014 after Implementation	deer/mi^2	--	10.5	10.1	9.6	10.0	9.9
		% of 1954	--	54%	52%	49%	52%	51%
	2040 at Stem Exclusion	deer/mi^2	--	9.2	8.8	8.4	8.8	8.7
		% of 1954	--	48%	46%	43%	45%	45%
North Central Prince of Wales Biogeographic Province (all WAAs)	1954	deer/mi^2	19.7	--	--	--	--	--
	2013	deer/mi^2	14.6	--	--	--	--	--
		% of 1954	74%	--	--	--	--	--
	2014 after Implementation	deer/mi^2	--	14.5	14.4	14.4	14.4	14.4
		% of 1954	--	74%	73%	73%	73%	73%
	2040 at Stem Exclusion	deer/mi^2	--	14.1	14.0	13.9	14.0	14.0
		% of 1954	--	71%	71%	71%	71%	71%
Northern Portion of Prince of Wales Island 3/	1954	deer/mi^2	18.0	--	--	--	--	--
	2013	deer/mi^2	13.6	--	--	--	--	--
		% of 1954	76%	--	--	--	--	--
	2014 after Implementation	deer/mi^2	--	13.6	13.5	13.4	13.5	13.5
		% of 1954	--	76%	75%	75%	75%	75%
	2040 at Stem Exclusion	deer/mi^2	--	13.1	13.0	12.9	13.0	13.0
		% of 1954	--	73%	72%	72%	72%	72%

1/ Deer habitat capability calculated from the deer model for winter habitat (all elevations). Habitat Suitability Indices (HSIs) were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest units were treated as even-aged; no predation was included.
2/ All non-NFS lands were assumed to be harvested.
3/ Includes WAAs 1107, 1212, 1213, 1214, 1315, 1316, 1317, 1318, 1319, 1323, 1332, 1420, 1421, 1422, 1527, 1528, 1529, and 1530.
Source: GIS Database, deer_model.aml

At the biogeographic province scale, deer habitat capability is currently 14.6 deer per square mile, decreasing to 14.4 deer per square mile under all action alternatives at project completion (a reduction of approximtely1 percent) and to between 13.9 to 14.0 deer per square mile at stem exclusion for the action alternatives (a total reduction of 4 to 5 percent; Table WLD-26). Taking into account only WAAs in the northern portion of Prince of Wales Island, deer habitat capability (currently 13.6 deer per square mile) would decrease to between 13.4 and 13.6 deer per square mile at project completion, and to between 12.9 and 13.1 deer per square mile at stem exclusion, depending on alternative. Under all action alternatives, 75 percent of the historic habitat capability would remain on the northern portion of Prince of Wales Island; at stem exclusion 72 percent would remain (Table WLD-26). Under all alternatives, 71 percent of WAAs (15 of 21 WAAs) in the biogeographic province would support less than 18 deer per square mile at project completion and at stem exclusion (the same as the current number). Thus, although portions of the larger landscape surrounding the Big Thorne project area would continue to provide sufficient deer habitat to maintain a sustainable wolf population, there remain substantial areas (including the project area WAAs) with lower quality habitat that, on their own, would not be able to support a local population (i.e., population sinks). In these areas, local population persistence would continue to rely on dispersal of wolves from surrounding areas (source populations). The effects presented here for all alternatives are within the range disclosed by the 2008 Forest Plan FEIS (USDA Forest Service 2008c), to which this analysis tiers.

The north-central and central portions of Prince of Wales Island have an extensive road system, which provides access to hunters and trappers. All action alternatives would result in the construction of new roads, though most stem from existing road systems and all would eventually be closed and stored within 1 to 5 years of timber harvest activities (for 1 to 5 years after timber sale activities the roads would remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30; see the Transportation section). Ongoing and foreseeable timber harvest projects may also increase open road density. These projects include the completion of NEPA-approved projects like Control Lake in WAAs 1318 and 1319, micro timber sales in all WAAs; and state timber projects in WAAs 1315 and 1420. Implementation of the Prince of Wales ATM, which involves road closures, would reduce access on NFS lands.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effect to wolves because no timber would be harvested and no roads would be constructed. Modeled deer densities would remain at currently estimated levels in 2013 (Table WLD-24). However, indirectly, over time there would be a reduction in modeled deer densities as previously harvested stands move into the stem exclusion stage (Table WLD-23). Reductions from existing (2013) amounts at stem exclusion would be greatest in WAA 1420 (11 percent), followed by WAAs 1315 (7 percent), 1318 (5 percent), and 1319 (4 percent), respectively (Table WLD-24). In all WAAs this equates to a reduction in modeled deer densities of 0.1 deer per square mile from the existing level (Table WLD-24). Under Alternative 1, 55 to 92 percent of the original (1954) habitat capability on NFS lands would remain after project implementation, and 49 to 88 percent would remain at stem exclusion (Table WLD-24).

No commercial thinning of previously harvested stands would occur under Alternative 1. Thus, habitat improvements in young-growth potentially benefiting deer, and thus wolves, over the long-term would occur more slowly (i.e., at the rate of natural succession) than under the other alternatives.

Existing total road densities below 1,200 feet elevation would remain, ranging from 0.7 to 2.5 miles per square mile (Table WLD-25). Total road density at elevations below 1,200 feet for Prince of Wales Island would be 1.0 mile per square mile under Alternative 1 (Table WLD-25).

No small OGR modifications are proposed under Alternative 1. Therefore, there would be no associated effects to wolves.

Cumulative Effects

Alternative 1 would not directly contribute to cumulative effect to wolves because no action would be undertaken under the Big Thorne Project; taking into account all landownerships and reasonably foreseeable timber projects, deer densities would be not change from current conditions, ranging from 6.1 to 15.7 deer per square mile depending on WAA (54 to 92 percent of original [1954] amounts; Table WLD-26). Over time, unthinned, previously harvested stands would reach the stem exclusion stage and deer habitat capability would be reduced to 5.8 to 15.1 deer per square mile depending on WAA (48 to 88 percent of original (1954) amounts (Table WLD-26). Reductions in deer habitat capability have the potential to reduce deer densities; however, foreseeable pre-commercial thinning projects would improve conditions for deer and would be expected to improve habitat capability. These improvements are not taken into account within the deer model. Thus, the effects of Alternative 1 has a low likelihood of resulting in local declines in deer habitat capability which could affect wolves, and thus hunters and trappers. The presence of WAAs with higher habitat capability and large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area, including the Honker Divide large OGR complex (200,000+ acres) and the nearly 40,000-acre Karta Wilderness to the west and south, respectively, help assure the persistence of wolf packs that may serve as source populations (Person et al. 1996; Person and Logan 2012).

Cumulative total road densities below 1,200 feet on Prince of Wales Island under Alternative 1 would be approximately 1.3 miles per square mile. Total road density below 1,200 feet would range from 1.6 to 2.7 miles per square mile within individual WAAs (Table WLD-27). Cumulative total road densities on Prince of Wales Island, taking all elevations into account, would be 1.1 miles per square mile under Alternative 1, ranging from 1.2 to 2.4 miles per square mile within the four project area WAAs.

Table WLD-27. Cumulative Road Density on All Ownerships Below 1,200 Feet Elevation by Alternative

Island/WAA	Road Status[3/, 4/]	Road Density by Alternative (mile/mile^2)[1/, 2/]				
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	Open	2.05	2.07	2.10	2.05	2.05
	Closed	0.62	0.67	0.68	0.63	0.63
	Total	**2.67**	**2.74**	**2.78**	**2.68**	**2.68**
1318	Open	2.30	2.30	2.30	2.30	2.30
	Closed	0.14	0.16	0.16	0.15	0.15
	Total	**2.44**	**2.46**	**2.46**	**2.44**	**2.45**
1319	Open	0.85	0.88	0.88	0.85	0.85
	Closed	0.76	0.84	0.86	0.78	0.81
	Total	**1.62**	**1.72**	**1.74**	**1.63**	**1.66**
1420	Open	1.47	1.49	1.50	1.47	1.47
	Closed	0.96	0.98	0.99	0.96	0.97
	Total	**2.43**	**2.46**	**2.49**	**2.43**	**2.44**
Prince of Wales Island[5/]	Open	0.92	0.92	0.92	0.92	0.92
	Closed	0.38	0.39	0.39	0.39	0.38
	Total	**1.30**	**1.31**	**1.32**	**1.30**	**1.30**

1/ Includes all land ownerships (NFS lands and non-NFS).
2/ WAA 1315 incorporates reasonably foreseeable roads on state lands; WAA 1318 incorporates reasonably foreseeable National Forest roads related to the Control Lake project; WAA 1319 incorporates reasonably foreseeable National Forest roads related to the Control Lake project; and WAA 1420 incorporates reasonably foreseeable roads on state lands.
3/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads.
4/ Note: All proposed System roads are treated as open roads; however, they will be closed within 1-5 years after harvest activities (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30).
5/ Includes 18 Prince of Wales Island WAAs; does not include the adjacent island WAAs (e.g., Kosciusko, Heceta, Tuxekan, Dall, etc.).

Cumulative road densities in all WAAs, except 1318, remain at a level beyond which increases in road density would not be expected to result in an increased risk of harvest (1.5 miles per square mile; Person and Russell 2008). However, wolf mortality concerns have already been identified on Prince of Wales Island.

Alternative 2

Direct and Indirect Effects

Timber harvest under Alternative 2 would result in an immediate reduction in modeled deer densities to 11.3 to 16.0 deer per square mile, depending on the WAA, a reduction of 4 to 5 percent from existing amounts (Table WLD-24). This equates to a reduction of one deer per square mile from existing (2013) levels in WAAs 1315, 1318, and 1319; there would be a reduction of 0.5 to 0.8 deer per square mile reduction depending on the WAA. At stem exclusion, deer densities would further be reduced to 10.0 to 14.9 deer per square mile, depending on the WAA, though in part this would be due to the succession of previously harvested stands into the stem exclusion stage (Table WLD-24). Long-term reductions in deer habitat capability from existing (2013) amounts at the stem exclusion stage under Alternative 2 would be the greatest in WAA 1420 (16 percent), followed by WAAs 1315 (11 percent), 1319 (9 percent), and 1318 (8 percent; Table WLD-24). This equates to a total reduction of 1.2 to 1.8 deer per square mile from existing (2013) levels (Table WLD-24). Under Alternative 2, 52 to 88 percent of the original (1954) habitat capability on NFS lands would remain after project implementation, and 46 to 85 percent would remain at stem exclusion (Table WLD-24). Thus, Alternative 2 has the potential to result in a local reduction in the wolf prey base and thus in the wolf density.

No commercial thinning of previously harvested stands is proposed under Alternative 2. Thus, habitat improvements in young growth potentially benefiting deer, and thus wolves, over the long term would occur more slowly than under the other action alternatives.

Total road densities on NFS lands below 1,200 feet would range from 0.8 to 2.6 miles per square mile, depending on the WAA, under Alternative 2 (Table WLD-25). Increases would be greatest in WAA 1319, followed by WAAs 1315, 1318, and 1420. Total road density under 1,200 feet elevation for Prince of Wales Island would be 1.0 miles per square mile under Alternative 2, the same as current road density. Therefore, Alternative 2 would only locally increase human access in the project area; however, this is an area where wolf mortality concerns have been identified.

No small OGR modifications are proposed under Alternative 2. Therefore there would be no associated effects to wolves.

Cumulative Effects

With implementation over the next decade, Alternative 2 in combination with past, ongoing and foreseeable projects would reduce modeled deer densities to 5.9 to 15.0 deer per square mile at project completion, depending on the WAA (52, 56, 73, and 89 percent of the original [1954] habitat capability in WAAs 1420, 1315, 1319, and 1318, respectively; Table WLD-26). Approximately 25 years after harvest, when harvested stands reach the stem exclusion stage, cumulative deer densities would range from 5.6 to 14.4 deer per square mile, depending on the WAA (46, 53, 70, and 85 percent of the original [1954] habitat capability in WAAs 1420, 1315, 1319, and 1318, respectively; Table WLD-26). This equates to a total cumulative reduction of 10.6 deer per square mile in WAA 1420, 7.5 deer per square mile in WAAs 1315, 6.3 deer per square mile in WAA 1319, and 1.0 deer per square mile in WAA 1318 (Table WLD-26). Thus, Alternative 2 may result in local declines in the deer population due to reduced habitat capability which could affect wolves, and thus hunters and trappers. The presence of WAAs with higher habitat capability and large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness), help assure the persistence of wolf packs that may serve as source populations (Person et al. 1996; Person and Logan 2012).

Cumulative total road densities below 1,200 feet under Alternative 2 on Prince of Wales Island would be approximately 1.3 miles per square mile, ranging from 1.7 to 2.7 miles per square mile within individual project area WAAs (Table WLD-27). Cumulative total road densities on Prince of Wales Island, taking all elevations into account, would be approximately 1.1 miles per square mile under Alternative 2, ranging from 1.3 to 2.5 miles per square mile within individual project area WAAs (see Table WLD-29 in the Marten section). Alternative 2 would not be expected to affect wolf harvest rates (i.e., through increased access) in any project area WAAs because existing total cumulative road densities in WAAs 1315, 1319, and 1420 are already at a level beyond which additional increases would increase harvest risk (i.e., above 1.5 miles per square mile; Person and Russell 2008) and because the increase in WAA 1318 is minor (less than 0.1 mile per square mile; Table WLD-29). However, wolf mortality concerns have already been identified on Prince of Wales Island.

Alternative 3

Direct and Indirect Effects

Timber harvest under Alternative 3 would result in an immediate reduction in modeled deer densities to 10.8 to 15.5 deer per square mile, depending on the WAA, a reduction of 5 to 9 percent from existing (2013) amounts (Table WLD-24). This equates to a reduction of 0.7 to 1.2 deer per square mile from existing levels in all project area WAAs. At stem exclusion, deer densities would range from 9.5 to 14.4 deer per square mile, depending on the WAA, (Table WLD-24). Long-term reductions in deer habitat capability (at the stem exclusion stage) from existing (2013) amounts under Alternative 3 would be the greatest in WAA 1420 (20 percent), followed by WAAs 1315 (14 percent), 1319 (10 percent), and 1318 (9 percent). This equates to a total reduction of 1.3 to 2.3 deer per square mile from existing (2013) levels depending on the WAA (Table WLD-24). Under Alternative 3, 50 to 88 percent of the original (1954) habitat capability on NFS lands would remain after project implementation, and 44 to 84 percent would remain at stem exclusion (Table WLD-24). Reductions in all WAAs under Alternative 3 would be the greatest among the alternatives. Thus, Alternative 3 has the potential to result in a local reduction in the wolf prey base and thus potentially in the wolf density. These effects would be reduced to some extent because Alternative 3 would also result in the commercial thinning of 2,299 acres of young growth which would improve deer habitat quality by increasing forage availability (Hanley 2005).

Total road densities on NFS lands under 1,200 feet elevation would range from 0.8 to 2.6 miles per square mile, depending on the WAA, under Alternative 3 (Table WLD-25). Increases would be greatest in WAA 1315, followed by WAAs 1420, 1318, and 1319. Total road density under 1,200 feet elevation for Prince of Wales Island would remain at

1.0 mile per square mile under Alternative 3. Therefore, Alternative 3 would only locally increase human access in the project area, but more so than the other alternatives; however, this is an area where wolf mortality concerns have been identified.

OGR modifications proposed under Alternative 3 would maintain or reduce inclusion of habitat suitable for wolf dens sites and other areas identified by the interagency review team (IRT) as being important to wolves (see Table OGR-2 and discussion in the Biodiversity discussion). With the exception of the small OGR in VCUS 5820 (Baird Peak) small OGR modifications under Alternative 3 would reduce inclusion of deep snow deer winter range (reduction of 1,321 acres) and low-elevation POG, which is indicative of higher value habitat (reduction of 2,736 acres). Harvest of these areas would reduce habitat capability for deer and thus the prey base for wolves. Additionally, with the exception of small OGRs in VCUs 5960 (Steelhead) and 5850 (Sandy Beach), inclusion of areas identified as being important for landscape connectivity would be reduced (see Table OGR-2 and discussion in the Biodiversity subsection). Future timber harvest and road building in these areas would have the potential to reduce the ability of wolves to move and disperse or increase the risk of harvest. However, areas relocated from existing small OGRs typically included areas of previous harvested and roads, traded for areas with fewer impacts (road miles and young growth acres). Thus in some cases this resulted in a tradeoff between inclusion of low-elevation POG/deer winter habitat and higher elevation areas with fewer acres of POG and young-growth and fewer roads.

Cumulative Effects

With implementation over the next decade, Alternative 3 in combination with past, ongoing, and foreseeable projects reduce modeled deer densities to 4.8 to 14.8 deer per square mile at project completion, depending on the WAA (49, 55, 72, and 88 percent of the original [1954] habitat capability in WAAs 1420, 1315,1319, and 1318, respectively; Table WLD-26). Approximately 25 years after harvest, when stands reach the stem exclusion stage, cumulative deer densities would range from 5.5 to 14.2 deer per square mile, depending on the WAA (43, 51, 69, and 84 percent of original [1954] habitat capability in WAAs 1420, 1315, 1319, and 1318, respectively; Table WLD-26). This equates to a cumulative reduction of 11.0 deer per square mile in WAA 1420, 7.8 deer per square mile in WAA 1315, 6.5 deer per square mile in WAA 1319, and 1.1 deer per square mile in WAA 1318 from original (1954) habitat capability (Table WLD-26). Thus, Alternative 3 may result in local declines in the deer population due to reduced habitat capability which could affect wolves, and thus hunters and trappers. However, thinning proposed under Alternative 3, in combination with ongoing and foreseeable thinning conducted various watershed restoration plan in the project area WAAs, would mitigate these effects to some extent. Additionally, the presence of WAAs with higher habitat capability and large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness), help assure the persistence of wolf packs that may serve as source populations (Person et al. 1996, Person and Logan 2012).

Cumulative total road densities below 1,200 feet on Prince of Wales Island under Alternative 3 would be approximately 1.3 miles per square mile, ranging from 1.7 to 2.8 miles per square mile within individual project area WAAs (Table WLD-27). Cumulative total road densities on Prince of Wales Island, taking all elevations into account, would be

1.1 miles per square mile under Alternative 3, ranging from 1.3 to 2.5 miles per square mile within individual project area WAAs (see Table WLD-29 in the Marten discussion). Alternative 3 would not be expected to affect wolf harvest rates (i.e., through increased access) in any project area WAAs because existing total cumulative road densities in WAAs 1315, 1319, and 1420 are already at a level beyond which additional increases would increase harvest risk (i.e., above 1.5 miles per square mile; Person and Russell 2008) and because the increase in WAA 1318 is minor (approximately 0.1 mile per square mile; Table WLD-29). However, wolf mortality concerns have already been identified on Prince of Wales Island.

Alternative 4

Direct and Indirect Effects

Effects to modeled deer densities, and thus the wolf prey base, under Alternative 4 would be the least among the alternatives (Table WLD-24). Timber harvest under Alternative 4 would result in an immediate reduction in modeled deer densities to 11.3 to 16.0 deer per square mile, depending on the WAA, a reduction of 3 to 5 percent from existing (2013) amounts (Table WLD-24). This equates to a reduction of 0.5 to 0.8 deer per square mile from existing levels in all project area WAAs. At stem exclusion, deer densities would range from 10.0 to 14.9 deer per square mile, depending on the WAA (Table WLD-24). Long-term reductions in deer habitat capability (at the stem exclusion stage) from existing (2013) amounts under Alternative 4 would be the greatest in WAA 1420 (15 percent), followed by WAAs 1315 (11 percent), 1319 (9 percent), and 1318 (7 percent). This equates to a total reduction of 1.1 to 1.8 deer per square mile from existing (2013) levels depending on the WAA (Table WLD-24). Under Alternative 4, 52 to 89 percent of the original (1954) habitat capability on NFS lands would remain after project implementation, and 47 to 86 percent would remain at stem exclusion (Table WLD-24). Thus, Alternative 4 has the potential to result in a local reduction in the wolf prey base and thus potentially in wolf density. However, these effects would be reduced to some extent because Alternative 4 would also result in the commercial thinning of 1,888 acres of young-growth which would improve deer habitat quality.

Total road densities on NFS lands below 1,200 feet elevation would range from 0.7 to 2.5 miles per square mile, depending on the WAA, under Alternative 4 (Table WLD-25). Increases would be greatest in WAA 1315, followed by WAAs 1318/1420, and 1319. Total road density under 1,200 feet elevation for Prince of Wales Island would be 1.0 mile per square mile under Alternative 4, the same as existing. Therefore, Alternative 4 would only locally increase human access in the project area; however, this is an area where wolf mortality concerns have been identified.

Effects to wolves would be mitigated through the implementation of harvest prescriptions and modifications to OGRs proposed under Alternative 4 that increase inclusion of deer winter habitat or connectivity as compared to the other alternatives. The utilization of uneven-aged management (e.g., 25 percent retention) and two-aged harvest in the Phase 2 area (VCUs 5780 and 5971) and in some units on the fringes of the Honker large OGR complex would benefit wolves by creating edge habitats that deer prefer in proximity to areas of cover. Wolves would also directly benefit from small OGR modifications proposed under Alternative 4 in VCUs 5830 (Ratz Harbor), 5950 (Steelhead Drainage), 5960 (Control Lake), and 5972 (Angel Lake) which protect known wolf dens (although known wolf dens are already afforded protection by the 1,200-foot buffer under the Forest Plan Wolf standards and guidelines) or other wolf habitat as identified by the 2008/2011 IRT (see Biodiversity discussion above and Table OGR-2); OGR modifications proposed in other VCUs would increase inclusion of deer winter range (net increase of 1,019 acres) and areas identified as being important for landscape connectivity in the reserve system (net increase in 2,684 acres of low-elevation POG), and thus indirectly benefit wolves (see discussion under Deer and under Issue 2 above).

Cumulative Effects

Cumulative reductions in deer habitat capability under Alternative 4 would be the least among the alternatives (Table WLD-26). With implementation over the next decade, Alternative 4 in combination with past, ongoing, and foreseeable projects reduce modeled deer densities to 5.9 to 15.1 deer per square mile at project completion, depending on the WAA (52, 57, 73, and 89 percent of the original [1954] habitat capability in WAAs 1420, 1315, 1319, and 1318, respectively; Table WLD-26). Approximately 25 years after harvest, when stands reach the stem exclusion stage, cumulative deer densities would range from 5.6 to 14.4 deer per square mile, depending on the WAA (45, 53, 70, and 86 percent of original [1954] habitat capability in WAAs 1420, 1315, 1319, and 1318, respectively; Table WLD-26). This equates to a cumulative reduction of 10.6 deer per square mile in WAA 1420, 7.5 deer per square mile in WAA 1315, 6.4 deer per square mile in WAA 1319, and 1.0 deer per square mile in WAA 1318 from original (1954) habitat capability (Table WLD-26). Thus, Alternative 4 may result in local declines in the deer population due to reduced habitat capability which could affect wolves, and thus hunters and trappers. However, thinning proposed under Alternative 4, in combination with ongoing and foreseeable thinning conducted various watershed restoration plans would mitigate these effects to some extent. Additionally, the presence of WAAs with higher habitat capability and large reserve areas (e.g., the Honker Divide large OGR and Karta Wilderness) in the vicinity of the project area help assure the persistence of wolf packs that may serve as source populations (Person et al. 1996; Person and Logan 2012).

Cumulative total road densities below 1,200 feet on Prince of Wales Island under Alternative 4 would be approximately 1.3 miles per square mile, ranging from 1.6 to 2.7 miles per square mile within individual project area WAAs (Table WLD-27). Cumulative total road densities on Prince of Wales Island, taking all elevations into account, would be approximately 1.1 miles per square mile under Alternative 4, ranging from 1.2 to 2.4 miles per square mile within individual project area WAAs (see Table WLD-29 in the Marten discussion). Alternative 4 would not be expected to affect wolf harvest rates (i.e., through increased access) in any project area WAAs because existing total cumulative road densities in WAAs 1315, 1319, and 1420 are already at a level beyond which additional increases would increase harvest risk (i.e., above 1.5 miles per square mile; Person and Russell 2008) and because the increase in WAA 1318 is minor (less than 0.1 mile per square mile; Table WLD-29). However, wolf mortality concerns have already been identified on Prince of Wales Island.

Alternative 5

Direct and Indirect Effects

Effects to modeled deer densities, and thus the wolf prey base, under Alternative 5 would be between Alternatives 2 and 3 (Table WLD-24). Timber harvest under Alternative 5 would result in an immediate reduction in modeled deer densities to 11.2 to 15.8 deer per square mile, depending on the WAA, a reduction of 4 to 5 percent from existing (2013) amounts (Table WLD-24). This equates to a reduction of 0.6 to 0.9 deer per square mile from existing levels in all project area WAAs. At stem exclusion, deer densities would range from 9.9 to 14.7 deer per square mile, depending on the WAA, (Table WLD-24). Long-term reductions in deer habitat capability (at the stem exclusion stage) from existing (2013) amounts under Alternative 4 would be the greatest in WAA 1420 (16 percent), followed by WAAs 1315 (12 percent), 1319 (9 percent), and 1318 (8 percent). This equates to a total reduction of 1.1 to 2.0 deer per square mile from existing (2013) levels depending on the WAA (Table WLD-24). Under Alternative 5, 52 to 89 percent of the original (1954) habitat capability on NFS lands would remain after project implementation, and 46 to 85 percent would remain at stem exclusion (Table WLD-24). Thus, Alternative 5 has the potential to result in a local reduction in the wolf prey base and thus potentially in wolf density. However, these effects would be reduced to some extent because Alternative 5 would also result in the commercial thinning of 1,850 acres of young-growth which would improve deer habitat quality.

Total road densities on NFS lands under 1,200 feet elevation would range from 0.7 to 2.5 miles per square mile, depending on the WAA, under Alternative 5 (Table WLD-25). Increases would be greatest in WAA 1319, followed by WAAs 1318, and 1315/1420. Total road density under 1,200 feet elevation for Prince of Wales Island would be 1.0 miles per square mile under Alternative 5, the same as existing. Therefore, Alternative 5 would only locally increase human access in the project area; however, this is an area where wolf mortality concerns have been identified.

No small OGR modifications are proposed under Alternative 5. Therefore there would be no associated effects to wolves.

Cumulative Effects

Cumulative reductions in deer habitat capability under Alternative 5 would be comparable to Alternatives 2 and 4 (Table WLD-26). With implementation over the next decade, Alternative 5 in combination with past, ongoing, and foreseeable projects reduce modeled deer densities to 5.9 to 15.0 deer per square mile at project completion, depending on the WAA (51, 56, 73, and 89 percent of the original [1954] habitat capability in WAAs 1420, 1315,1319, and 1318, respectively; Table WLD-26). Approximately 25 years after harvest, when stands reach the stem exclusion stage, cumulative deer densities would range from 5.6 to 14.4 deer per square mile, depending on the WAA (45, 52, 70, and 85 percent of original [1954] habitat capability in WAAs 1420, 1315, 1319, and 1318, respectively; Table WLD-26). This equates to a cumulative reduction of 10.7 deer per square mile in WAA 1420, 7.6 deer per square mile in WAA 1315, 6.3 deer per square mile in WAA 1319, and 1.0 deer per square mile in WAA 1318 from original (1954) habitat capability (Table WLD-26). Thus, Alternative 5 may result in local declines in the deer population due to reduced habitat capability which could affect wolves, and thus hunters and trappers. However, thinning proposed under Alternative 5, in combination with ongoing and foreseeable thinning conducted various watershed restoration plans would mitigate these effects to some extent. Additionally, the presence of WAAs with higher habitat capability and large reserve areas (e.g., the Honker Divide large OGR and Karta Wilderness) in the vicinity of the project area help assure the persistence of wolf packs that may serve as source populations (Person et al. 1996; Person and Logan 2012).

Cumulative total road densities below 1,200 feet on Prince of Wales Island under Alternative 5 would be approximately 1.3 miles per square mile, ranging from 1.7 to 2.7 miles per square mile within individual project area WAAs (Table WLD-27). Cumulative total road densities on Prince of Wales Island, taking all elevations into account, would be approximately 1.1 miles per square mile under Alternative 5, ranging from 1.2 to 2.4 miles per square mile within individual project area WAAs (see Table WLD-29 in the Marten discussion). Alternative 5 would not be expected to affect wolf harvest rates (i.e., through increased access) in any project area WAAs because existing total cumulative road densities in WAAs 1315, 1319, and 1420 are already at a level beyond which additional increases would increase harvest risk (i.e., above 1.5 miles per square mile; Person and Russell 2008) and because the increase in WAA 1318 is minor (less than 0.1 mile per square mile; Table WLD-29). However, wolf mortality concerns have already been identified on Prince of Wales Island.

Conclusion

Effects to wolves from reductions in deer habitat capability would occur under all alternatives. Taking only NFS lands into account, long-term (stem exclusion) deer habitat capability would be greatest under Alternative 3, followed by Alternatives 2, 5,4, and 1. When taking both NFS and non-NFS lands into account deer habitat capability would be comparable under any of the alternatives, with differences in habitat capability of approximately 4 percent or less between alternatives. None of the project area WAAs alone provides a habitat capability of 18 deer per square mile, generally considered under the Forest Plan to be sufficient to maintain sustainable wolf populations and taking into account hunting. Additional, project-related effects to deer habitat capability under the action alternatives, and reductions due to forest succession in previously harvested stands, have the potential to reduce the prey base for wolves. Accordingly, there would be some reduction in the ability of project area WAAs to maintain a sustainable wolf population, based on deer habitat capability alone. However, the Forest Plan standard and guideline was intended to apply at a broader scale. At the scale of the biogeographic province, the cumulative effect of all alternatives would be the maintenance of approximately 13.9 to 14.0 deer per square mile 25 years after harvest (at stem exclusion). This indicates that regardless of the alternative selected, the ability of the larger area surrounding the project to maintain a sustainable wolf population would not change. The effects to deer habitat capability presented here for all alternatives are within the range disclosed by the 2008 Forest Plan FEIS (USDA Forest Service 2008c), to which this analysis tiers. Thus, they are consistent with determinations made for subsistence and viability.

Benefits to wolves in the project area would be provided indirectly (by improving habitat for deer) through young-growth management. Alternatives 3, 4 and 5 would also result in the commercial thinning of young-growth acres which would improve deer habitat quality.

Cumulative road densities would increase under all action alternatives. Impacts to wolves related to increased human access along the road system would generally be greatest under Alternative 3, followed by Alternatives 2, 4, 5, and 1. Road densities in all project area WAAs (lands below 1,200 feet elevation) currently exceed the Forest Plan recommended level of 0.7 to 1.0 mile per square mile for managing harvest-related morality risk both when considering only NFS lands and all landownerships, except WAA 1318 for NFS lands only. Further increases in road density have the potential to increase wolf harvest mortality risk; however, Person and Russell (2008) concluded that road densities above 1.5 miles per square mile (0.9 km/km^2) had little additional effect on harvest rates. Therefore, minor increases in road density under any of the alternatives would not be expected to substantially increase harvest risk because existing road densities in project area WAAs are either above this number, or increases in road density are minor. The Forest Service will continue to work with ADF&G and the Federal Board of Subsistence to develop regulations to manage harvest levels. Additional steps may include development of a wolf habitat management plan that incorporates access management and habitat enhancement.

American Marten

Direct and Indirect Effects – All Alternatives

Timber harvest has the potential to directly affect marten through disturbance which may displace individuals or adversely affect young. Through the removal of forest cover and old-growth ecosystem features such as decadent live trees and snags (POG), timber harvest would reduce the vertical and horizontal structural complexity important to marten in relation to prey access, denning and resting sites, escape from predation, and thermoregulation (Buskirk and Zielinski 1997; Hargis et al. 1999; Flynn and Schumacher 2001). Forest fragmentation resulting from timber harvest may also alter patterns of occupancy by marten (Thompson and Harestad 1994; Bissonette et al. 1997; Chapin et al. 1998; see Table WLD-17 for a patch size analysis by alternative). Uneven-aged harvest and two-aged harvest would maintain a higher habitat value in harvested stands, compared to even-aged harvest, by maintaining some structural complexity (see Table WLD-23 for a comparison of alternatives by harvest prescription). Legacy retention in harvested units would also maintain some habitat value in harvested stands. Alternatives that result in the greatest reduction in deep snow marten habitat (high-volume POG at or below 800 feet elevation) would be expected to have the greatest effects to marten. The greatest effects to marten under all alternatives would occur in WAA 1319 (Table WLD-28).

Increased human access associated with new roads may result in increased marten vulnerability to harvest, particularly along open roads (Flynn et al. 2004). All alternatives would increase road densities (Table WLD-29). However, it should be noted that roads proposed for this project are typically temporary, short spurs that lead to the harvest units; therefore, they would only locally increase access.

Table WLD-28. Impacts to Deep Snow Marten Habitat by WAA and by Alternative

WAA	Original (1954) acres	2012 acres		Acres Impacted and Percent Reduction from Existing[1/]									
		Acres	% Original	Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5	
1315	24,839	9,293	37%	0	NA	281	-3%	581	-6%	270	-3%	317	-3%
1318	22,243	7,600	34%	0	NA	367	-5%	439	-6%	262	-3%	320	-4%
1319	18,092	11,820	65%	0	NA	770	-7%	928	-8%	731	-6%	795	-7%
1420	10,075	3,166	31%	0	NA	119	-4%	410	-13%	55	-2%	181	-6%
Total						**1,537**		**2,358**		**1,319**		**1,613**	

1/ High volume POG (SD 5S, 5N, 6/7) at or below 800 ft elevation.

Table WLD-29. Road Density at All Elevations on NFS Lands Only after Implementation of the Alternatives

Island/WAA	Road Status[2/, 3/]	Road Density by Alternative (mile/mile^2)[1/]				
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	Open	0.94	0.96	1.00	0.94	0.94
	Closed	0.93	1.00	1.02	0.93	0.93
	Total	1.87	1.96	2.02	1.87	1.87
1318	Open	0.34	0.34	0.34	0.34	0.34
	Closed	0.14	0.17	0.18	0.15	0.16
	Total	0.48	0.51	0.52	0.49	0.49
1319	Open	0.61	0.63	0.63	0.61	0.61
	Closed	0.58	0.64	0.65	0.59	0.62
	Total	1.19	1.27	1.28	1.20	1.23
1420	Open	1.00	1.01	1.02	1.00	1.00
	Closed	0.74	0.78	0.79	0.75	0.75
	Total	1.74	1.79	1.81	1.75	1.75

1/ Includes only NFS lands.
2/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads. All proposed System roads are treated as open roads; however, they will be closed within 1-5 years after harvest (for 1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30).

Marten were chosen as one of the design species in the 1997 Forest Plan because they exhibit a consistent close association with mature forests throughout their distributional range (Sturtevant et al. 1996). Under the current Forest Plan, the marten population are supported by the conservation strategy which works to maintain mature forest cover and coarse woody debris to provide structure important to marten for resting, denning, escape from predators, trapping refugia, and facilitate marten dispersal (see the discussion of OGR modifications under Alternatives 3 and 4 below).

Cumulative Effects – All Alternatives

Between 35 and 69 percent of the original (1954) deep snow marten habitat within the project area WAAs has been harvested or removed by other means (e.g., blow down; Table WLD-30). The Big Thorne Project would result in additional reductions in deep snow marten habitat, contributing to similar effects resulting from on-going and foreseeable timber harvest projects on NFS, state, and private lands.

The greatest cumulative reductions under all alternatives would occur in WAA 1420, followed by WAAs 1318, 1315, and 1319 (Table WLD-30). Given the sensitivity of marten to changes in habitat, there has likely already been some change in marten distribution in these WAAs due to the lack of connectivity. Young-growth stands also lack large hollow trees and root masses important for denning, though these features would be protected in harvested stands to some extent on NFS lands through implementation of the Legacy standard and guideline, which is intended to provide for the habitat needs of marten (developed for the 2008 Forest Plan to replace the 1997 Forest Plan marten habitat standard and guideline) across the Tongass. Further reductions in habitat could locally reduce the capacity of the area to support marten over the long-term (Flynn and Schumacher 1997). The Forest Plan conservation strategy as a whole will continue to be critical in maintaining a sustainable marten population in the project area WAAs.

Table WLD-30. Cumulative Effects to Deep Snow Marten Habitat by WAA and by Alternative

WAA	1954 acres	2012 acres	% Original	Percent Original (1954) Deep Snow Habitat Remaining[1/, 2/]				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	24,838	9,293	37	35	34	33	34	34
1318	22,243	7,600	34	34	33	32	33	33
1319	18,092	11,820	65	65	61	60	61	61
1420	10,075	3,166	31	31	30	27	31	29

1/ High volume POG (SD 5S, 5N, 6/7) at or below 800 ft elevation.
2/ WAA 1315 incorporates reasonably foreseeable harvest on state lands and misc. National Forest harvest; WAA 1318 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); WAA 1319 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); and WAA 1420 incorporates reasonably foreseeable harvest on state lands and misc. National Forest harvest.

The project area has an extensive road system and new roads associated with the Big Thorne Project as well as other forest management projects (see Chapter 2) would contribute to potential issues associated with human access and overexploitation of marten along the road system (Table WLD-31). However, implementation of the Prince of Wales Island ATM as well as the temporary nature of some project roads and closure and storage of all project system roads within 1 to 5 years after completion of timber harvest activities will mitigate these effects to some extent (note that for 1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30). Projected total road densities under the Prince of Wales ATM are 1.9 miles per square mile in WAA 1315, 1.8 miles per square mile in WAAs 1318 and 1420, and 1.0 mile per square mile in WAA 1319. There is no road density threshold for marten under the Forest Plan in part because it is not road density per se that is important to marten but rather the availability of roadless refugia (Flynn et al. 2007).

Table WLD-31. Cumulative Road Density on All Ownerships at All Elevations by Alternative

Island/WAA	Road Status[3/, 4/]	Road Density by Alternative (mile/mile^2)[1/, 2/]				
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	Open	1.86	1.87	1.90	1.86	1.86
	Closed	0.55	0.59	0.60	0.55	0.55
	Total	**2.41**	**2.47**	**2.50**	**2.42**	**2.42**
1318	Open	1.79	1.79	1.79	1.79	1.79
	Closed	0.11	0.12	0.12	0.11	0.11
	Total	**1.89**	**1.91**	**1.91**	**1.90**	**1.90**
1319	Open	0.63	0.65	0.66	0.63	0.63
	Closed	0.57	0.63	0.64	0.59	0.61
	Total	**1.21**	**1.28**	**1.30**	**1.22**	**1.24**
1420	Open	1.09	1.10	1.11	1.09	1.09
	Closed	0.67	0.70	0.71	0.67	0.68
	Total	**1.76**	**1.80**	**1.82**	**1.77**	**1.77**

1/ Includes all land ownerships (NFS lands and non-NFS).
2/ WAA 1315 incorporates reasonably foreseeable roads on state lands; WAA 1318 incorporates reasonably foreseeable National Forest roads related to the Control Lake project; WAA 1319 incorporates reasonably foreseeable National Forest roads related to the Control Lake project; and WAA 1420 incorporates reasonably foreseeable roads on state lands.
3/ Closed roads are defined as all NFS roads with Operating Maintenance Level = 1 plus all decommissioned NFS roads; open roads include all other NFS roads and all state and private roads.
4/ Note: all proposed System roads are treated as open roads; however, they will be closed within 1-5 years after harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30).

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects to marten or effects to deep snow marten habitat or connectivity because no timber harvest or road building would occur. However, indirectly because no commercial thinning would occur under Alternative 1, managed stands would continue to grow slowly and would provide little forage or structural diversity for marten during the stem exclusion stage, which may last for decades.

No small OGR modifications are proposed under Alternative 1. Therefore, there would be no associated connectivity or other effects to marten.

Cumulative Effects

Alternative 1 does not propose timber harvest or road building and therefore would not contribute to cumulative effects to marten. Taking into account past, ongoing, and foreseeable projects, Alternative 1 would reduce the amount of deep snow marten habitat to between 31 and 65 percent of the original (1954) levels, depending on the WAA (Table WLD-30). The POW ATM would be implemented under Alternative 1 which would decrease the number of open roads on the landscape, thereby reducing hunter access and associated trapping pressure. However, presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness) would contribute to the maintenance of a sustainable marten population.

Alternative 2

Direct and Indirect Effects

Alternative 2 would harvest 1,537 total acres of deep snow marten habitat, resulting in a decrease ranging from 3 to 7 percent from the existing amount depending on the WAA (Table WLD-28). Effects would be greatest in WAA 1319, followed by WAAs 1318, 1420, and 1315. However, because no commercial thinning would occur under Alternative 2, there would be no long-term benefits associated with the promotion of stand development toward a stage providing suitable marten habitat. Reductions in deep snow marten habitat under Alternative 2 may result in localized reductions the capability of the remaining habitat to support marten.

Alternative 2 would increase total road density on NFS lands to between 0.5 mile per square mile (WAA 1318) and 2.0 miles per square mile (WAA 1315) and thus would indirectly increase hunter access and associated trapping pressure (Table WLD-29). However, the actual increases due to the project would be small (approximately 0.1 mile per square mile or less) and 74 percent of the roads constructed under Alternative 2 would be temporary, which would limit this effect because they will be decommissioned after harvest activities.

No small OGR modifications are proposed under Alternative 2. Therefore, there would be no connectivity or other associated effects to marten.

Cumulative Effects

Under Alternative 2 the Big Thorne Project in combination with past, ongoing, and foreseeable projects would reduce deep snow marten habitat to between 30 and 61 percent of the original (1954) levels, depending on the WAA (Table WLD-30). Cumulative reduction in marten deep snow winter habitat may result in localized declines in marten densities or gaps in distributions. However, presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness), help assure the persistence of a sustainable marten population in the project area WAAs.

Cumulative total road densities (all land ownerships) under Alternative 2 would range from 1.3 (WAA 1319) to 2.5 (WAA 1315) miles per square mile (Table WLD-31). The POW ATM would be implemented under Alternative 2 which would decrease the number of open roads on the landscape, thereby reducing hunter access and associated trapping pressure.

Alternative 3

Direct and Indirect Effects

Alternative 3 would harvest 2,358 total acres of deep snow marten habitat, the most of any alternative, resulting in a decrease ranging from 6 to 13 percent from the existing amount depending on the WAA (Table WLD-28). Effects would be greatest in WAA 1420, followed by WAAs 1319, 1315/1318, respectively. Reductions in deep snow marten habitat under Alternative 3 may result in localized reductions the capability of the remaining habitat to support marten. This would be mitigated to some extent through the commercial thinning of approximately 2,299 acres under Alternative 3, which would have long-term benefits associated with the promotion of stand development toward a stage providing suitable marten habitat.

Alternative 3 would increase total road density on NFS lands to between 0.5 mile per square mile (WAA 1318) and 2.0 miles per square mile (WAA 1315; Table WLD-29), the most among the alternatives, and thus would indirectly increase hunter access and associated trapping pressure. Increases under Alternative 3 would range from less than 0.1 to 0.2 miles per square mile. However, 73 percent of roads constructed under Alternative 3 would be temporary, which would limit this effect because they will be decommissioned after harvest activities (Table 2-1).

Small OGR modifications under Alternative 3 would directly affect marten by reducing inclusion of deep snow marten habitat in all VCUs except VCU 5820 (a total reduction of 1,321 acres; Table OGR-2). Modifications would also reduce inclusion of streams (classes I-IV) in the reserve system (representative of riparian habitat for marten prey) in all VCUs except VCU 5790 and 5960; though in some cases this was a tradeoff for including OGR acres that contained less young-growth forest or fewer roads (Table OGR-2). Indirectly, small OGR modifications would affect functional connectivity between reserves. Assuming the mean minimum travel distance for marten of 8 miles (13 km) reported by Flynn (1991 as cited in Flynn and Schumacher 2001; note that the mean maximum travel distance reported in this study was 12 miles [20 km] and that travel distances of up to 39 miles [65 km] have been documented), and that corridors through POG are optimal, functional connectivity between OGRs in the project area for marten under Alternative 3 would be as follows:

- Small OGRs in VCUs 5790, 5800, and 5840 would remain functionally connected to each other and to the Honker large OGR complex via VCU 5790 though now only through a narrow connection; the connection through VCU 5780 and the connection between VCU 5840 and the beach now would be available for timber which would reduce the suitability of these areas for marten travel corridors;
- The small OGR in VCU 5950 would remain functionally connected (only through non-Federal land) to the Honker large OGR complex (though proposed harvest units in the area made available due to the OGR modifications would reduce this connection), and to the small OGR in VCU 5940 (through roadless);
- Small OGRs in 5960 and 5972 would remain functionally connected to large reserves (Honker large OGR complex and/or Karta Wilderness) and to each other (through the Karta Wilderness). Small OGR modifications in VCU 5972 would make some acres available for timber harvest;
- Small OGRs in adjacent VCUs 5820/5830 would remain functionally connected to each other and (via VCU 5820) to the northern piece of the small OGR in VCU 5810 and then to the small OGR in VCU 5720. The OGR modifications in these VCUs have made acres available for timber harvest;
- The southern piece of the small OGR in VCU 5810 would remain functionally connected (through roadless) to the Honker large OGR in VCUs 5740 and 5750; small OGR modifications in VCU 5810 would make some acres available for timber harvest; and

§ Small OGRs in adjacent VCUs 5850/5860 would remain functionally connected to each other but would no longer be connected to the small OGR in VCU 5840 due to the presence of harvest units south of Sal Creek and near Sandy Beach. The OGR modifications in these VCUs would make acres available for timber harvest.

Cumulative Effects

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would reduce deep snow marten habitat to between 27 and 60 percent of the original (1954) levels depending on the WAA, the greatest reduction among the alternatives (Table WLD-30). Cumulative reduction in marten deer snow winter habitat may result in localized declines in marten densities, and thus local gaps in marten distribution, particularly in WAA 1420 where less than a third of the original habitat remains. However, the presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness), help assure the persistence of a sustainable marten population in the project area WAAs.

Cumulative road densities (all land ownerships) under Alternative 3 would range from 1.3 (WAA 1319) to 2.5 (WAAs 1315) miles per square mile (Table WLD-31). The POW ATM would be implemented under Alternative 3 which would decrease the number of open roads on the landscape, thereby reducing hunter access and associated trapping pressure.

Alternative 4

Direct and Indirect Effects

Alternative 4 would harvest 1,319 total acres of deep snow marten habitat, the least of any action alternative, resulting in a decrease ranging from 2 to 6 percent from the existing amount depending on the WAA (Table WLD-28). Effects would be greatest in WAA 1319, followed by WAAs 1315/1318 and 1420. Reductions in deep snow marten habitat under Alternative 4 may result in localized reductions the capability of the remaining habitat to support marten. This would be mitigated to some extent through the commercial thinning of approximately 1,888 acres under Alternative 4, which would have long-term benefits associated with the promotion of stand development toward a stage providing suitable marten habitat.

Alternative 4 would increase total road density on NFS lands to between 0.5 mile per square mile (WAA 1318) and 1.9 miles per square mile (WAA 1315; Table WLD-29), the least among the action alternatives, and thus would indirectly increase hunter access and associated trapping pressure. However, 98 percent of roads constructed under Alternative 4 would be temporary, which would limit this effect because they will be decommissioned after harvest activities.

Small OGR modifications under Alternative 4 would directly affect marten by increasing inclusion of deep snow marten habitat (total increase of 1,019 acres) and streams (classes I-IV; representative of riparian habitats) in all VCUs except 5820 (Table OGR-2). They would also increase the inclusion of the largest contiguous blocks of habitat and old-growth travel corridors, which are important to marten. Collectively these modifications would reduce the amount of marten habitat available for harvest. Indirectly, small OGR modifications would affect functional connectivity between reserves. Assuming the minimum travel distance for marten of 8 miles (13 km) reported by Flynn (1991 as cited in Flynn and Schumacher 2001; note that the mean maximum travel distance reported in this study was 12 miles [20 km] and that travel distances of up to 39 miles [65 km] have been documented), and that corridors through POG are optimal, functional connectivity between OGRs in the project area for marten under Alternative 4 would be as follows:

- Small OGRs in VCUs 5790, 5800, and 5840 would remain functionally connected to each other and to the Honker large OGR complex via VCUs 5780 and 5790 and connectivity to the large OGR would be enhanced through a direct connection provided by the addition of OGR acreage in VCU 5780;
- The small OGR in VCU 5950 would remain functionally connected (only through non-Federal land) to the Honker large OGR and to the small OGR in VCU 5940; OGR modifications in VCU 5950 would enhance connectivity through greater inclusion of the POG travel corridor;
- Small OGRs in 5960 and 5972 would remain functionally connected to large reserves (Honker large OGR complex and/or Karta Wilderness) and to each other (through the Karta Wilderness) though through a different route;
- Small OGRs in adjacent VCUs 5820/5830 would remain functionally connected to each other and (via VCU 5820) to the northern piece of the small OGR in VCU 5810 and then the small OGR in VCU 5720;
- The southern piece of the small OGR in VCU 5810 would remain functionally connected (through the roadless) to the Honker large OGR in VCUs 5740 and 5750; and
- Small OGRs in adjacent VCUs 5850/5860 would remain functionally connected but connectivity to the small OGR in VCU 5840 would be reduced due to the presence of harvest units south of Sal Creek.

Cumulative Effects

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would reduce deep snow marten habitat to between 31 and 61 percent of the original levels (Table WLD-30). Cumulative reduction in marten deer snow winter habitat may result in localized declines in marten densities, and thus local gaps in marten distribution, particularly in WAA 1420 where only a third of the original habitat remains. However, presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness), help assure the persistence of a sustainable marten population in the project area WAAs.

Cumulative road densities (all land ownerships and at all elevations) under Alternative 4 would range from 1.2 (WAA 1319) to 2.4 (WAAs 1315) miles per square mile (Table WLD-31). The POW ATM would be implemented under Alternative 4 which would decrease the number of open roads on the landscape, thereby reducing hunter access and associated trapping pressure.

Alternative 5

Direct and Indirect Effects

Alternative 5 would harvest 1,613 total acres of deep snow marten habitat, resulting in a decrease ranging from 3 percent to 7 percent from the existing amount depending on the WAA (Table WLD-28). The magnitude of effects under Alternative 5 would fall between Alternatives 2 and 3. Effects under Alternative 5 would be greatest in WAA 1319, followed by WAAs 1420, 1318, and 1315, respectively. Reductions in deep snow marten habitat under Alternative 5 may result in localized reductions in the capability of the remaining habitat to support marten. This would be mitigated to some extent through the commercial thinning of approximately 1,850 acres under Alternative 5, which would have long-term benefits associated with the promotion of stand development toward a stage providing suitable marten habitat.

Alternative 5 would increase total road density on NFS lands to between 0.5 mile per square mile (WAA 1315) and 1.9 miles per square mile (WAA 1315; Table WLD-29), the least among the action alternatives, and thus would indirectly increase hunter access and associated trapping pressure. However, 95 percent of roads constructed under Alternative 5 would be temporary, which would limit this effect because they will be decommissioned after harvest activities.

No small OGR modifications are proposed under Alternative 5. Therefore there would be no connectivity or other associated effects to marten.

Cumulative Effects

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would reduce deep snow marten habitat to between 29 and 61 percent of the original levels (Table WLD-30). Cumulative reduction in marten deer snow winter habitat may result in localized declines in marten densities, and thus local gaps in marten distribution, particularly in WAA 1420 where only a third of the original habitat remains. However, presence of large, undisturbed blocks of habitat on Prince of Wales Island adjacent to the project area (e.g., the Honker Divide large OGR and Karta Wilderness), help assure the persistence of a sustainable marten population in the project area WAAs.

Cumulative road densities (all land ownerships) under Alternative 5 would range from 1.2 (WAA 1319) to 2.4 (WAA 1315) miles per square mile (Table WLD-31). The POW ATM would be implemented under Alternative 5 which would decrease the number of open roads on the landscape, thereby reducing hunter access and associated trapping pressure.

Conclusion

Loss of marten deep snow winter habitat could locally reduce the capacity of the area to support marten over the long-term (Flynn and Schumacher 1997). This is most likely in VCU 1420, where currently only 31 percent of the original deep snow marten habitat remains, with cumulative reductions (1 to 4 percent) occurring under each of the action alternatives. All of the alternatives would increase road densities which would indirectly affect marten by providing greater access for trapping and thus result in more demand on the marten population. All new and reconstructed roads under all alternatives would be closed within 1 to 5 years of timber harvest activities completion (i.e., 1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30). Additional closures would occur under the Prince of Wales ATM. Functional connectivity for marten between OGRs would be maintained under Alternatives 1, 2, and 5. Small OGR modifications under Alternative 3 would reduce functional connectivity between the Honker large OGR and small OGRs in VCUs 5790, 5800, and 5840 and between small OGRs in VCUs 5850 and 5840; modifications in other VCUs would maintain the existing level of connectivity. Small OGR modifications under Alternative 3 would also reduce the amount of deep snow marten habitat included in the reserve system. Small OGR modifications under Alternative 4 would maintain or enhance functional connectivity in all VCUs, except in VCU 5850; they would also increase the amount of deep snow marten habitat included in the reserve system. Effects to marten would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1.

Black Bear

Direct and Indirect Effects – All Alternatives

Preferred habitats for black bears, which include coastal, estuarine, and riparian areas, are protected by the Forest Plan conservation strategy. Therefore, none of the alternatives are expected to substantially affect the highest quality black bear habitats (see discussions under Alternatives 3 and 4 pertaining to small OGR modifications). Impacts to Class I salmon streams, which will be given the mandatory 100-foot buffer, are discussed in the Fish section of the FEIS. Impacts to low-elevation habitats (deep snow) are discussed under the Deer and Marten subsections above. Timber harvest (POG) also has the potential to adversely affect black bears through activities that create noise or disturbance. There are no known black bear dens within any of the proposed harvest units. For known den sites within the project area close to harvest units, a 300-foot buffer was applied under Alternative 5 to minimize disturbance and to maintain known denning sites.

Timber harvest of POG would increase forage availability for black bears over the short-term in the resulting early-successional plant communities. However, this food source typically lasts about 25 years post-logging in association with canopy closure. Over the long-term, timber harvest would decrease habitat suitability for black bears, due to the reduced understory forage in young-growth stands and loss of denning habitat in upland areas (e.g., large woody structures such as hollow logs and hollow living trees; Davies et al. 2012). Additionally, reductions in deer habitat capability resulting from timber harvest could reduce fawn productivity, and therefore the prey base for bears in the spring. However, due to the variety food consumed by bears and the short-term availability of fawns as a food source, it is unlikely that this will have a substantial effect to the black bear population. Under all alternatives, direct impacts would be greatest in WAA 1319 where the most timber harvest is proposed (Table WLD-32).

Timber harvest projects may also indirectly increase the susceptibility of black bears to over-harvest if road access is increased or improved. Although there is no road density threshold for black bears, it can be assumed that an increase in open roads, particularly in open habitats such as clearcuts, muskegs, and alpine areas, where bears forage and are easier to see, increases the potential for human-bear interactions. The amount of road access, quantified in terms of the amount of road construction and reconstruction proposed under each alternative, is representative of the potential for over-hunting (USDA Forest

Service 2008b). Under all alternatives, the potential for increased hunter access would be greatest in WAA 1319 where the most roads are proposed.

Table WLD-32. Productive Old-growth Harvest by WAA under each Alternative

WAA	Original (1954) Acres	2012		Acres Impacted and Percent Reduction from Existing				
		Acres	% Original	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
1315	58,438	27,663	47%	0	1,188 (-4%)	1,714 (-6%)	1,070 (-4%)	1,355 (-5%)
1318	66,254	32,285	49%	0	737 (-2%)	867 (-3%)	562 (-2%)	650 (-2%)
1319	61,624	47,387	77%	0	2,081 (-4%)	2,869 (-6%)	2,156 (-5%)	2,242 (-5%)
1420	32,205	18,006	56%	0	956 (-5%)	1,457 (-8%)	839 (-5%)	1,025 (-6%)
Total				**0**	**4,962**	**6,696**	**4,627**	**5,271**

Cumulative Effects – All Alternatives

Cumulative POG harvest under the action alternatives would reduce the percent of original (1954) POG remaining within the project area WAAs (Table WLD-33). Under all alternatives, cumulative reductions in habitat would be greatest in WAA 1315, followed by WAAs 1318, 1420, and 1319, respectively. This would contribute to similar effects resulting from ongoing and foreseeable harvest on NFS, state, and private lands. After timber harvest there would be a short-term (about 25 years) increase in the forage availability for bears, which may result in short-term population growth (Porter 2008). However, over the long-term (25-150 years), as the forest canopy closes, forage species would be reduced. This reduction in forage production may reduce carrying capacity for bears (Porter 2008). A main area of concern on Prince of Wales Island continues to be whether long-term bear carrying capacity can be maintained in the face of additional timber harvest and the transition of harvested stands to the stem exclusion stage which can last up to 150 years or more (Porter 2008). Young-growth stands generally lack large hollow trees and root masses important for denning, though these features would be protected in harvested stands to some extent on NFS lands under the Forest Plan. Commercial thinning under Alternatives 3, 4, and 5, in combination with pre-commercial thinning of young-growth stands on NFS lands (under the Luck Lake/Eagle Creek and North Thorne River watershed restoration plans) would improve habitat conditions for black bears over the short-term by increasing the period during which forage is available and over the long-term promote the development of larger trees which could provide suitable den sites.

Table WLD-33. Cumulative POG Harvest by WAA

WAA	1954 Acres	2012 Acres	% Original	Cumulative Percent Original (1954) POG Remaining[1/]				
				Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1315	58,438	27,663	47	46	44	43	44	44
1318	66,254	32,285	49	49	48	47	48	48
1319	61,624	47,387	77	77	74	72	73	73
1420	32,205	18,006	56	56	53	51	53	52

1/ WAA 1315 incorporates reasonably foreseeable harvest on state lands and misc. National Forest harvest; WAA 1318 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); WAA 1319 incorporates reasonably foreseeable National Forest harvest (Control Lake project and misc. projects); and WAA 1420 incorporates reasonably foreseeable harvest on state lands and misc.

Road building associated with past timber harvest in the project area WAAs has resulted in some of the highest road densities in Southeast Alaska. Cumulative total road densities on all land ownerships would increase under all alternatives, and would be greatest in WAA 1315, followed by WAAs 1318, 1420, and 1319, respectively (Table WLD-31). Increased harvest of bears due to human access along roads would be mitigated to some extent through the closure of system roads within 1 to 5 years of completion of timber sale activities (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30 (see Transportation section for additional detail). Other timber harvest projects on NFS and state lands that involve road construction also have the potential to result in road-related effects to black bears. However, in the foreseeable future, additional road storage and decommissioning would occur with implementation of the Prince of Wales ATM, as funding allows. Projected total road densities (all lands and all elevations) under the Prince of Wales ATM are 1.9 miles per square mile in WAA 1315, 1.8 miles per square mile in WAAs 1318 and 1420, and 1.0 mile per square mile in WAA 1319 (See Table WLD-31).

Alternative 1

Direct and Indirect Effects

Under Alternative 1, no timber would be harvested; therefore, this alternative would have no direct effects to black bears (Table WLD-32). However, overtime the existing early-successional stands would mature, reducing forage availability for black bears. Alternative 1 would also not have the beneficial effect of commercial thinning which would improve forage availability in young-growth stands for black bears.

Hunter access would not change as a result of the project because new roads would be constructed or reconstructed with total NFS road miles (open and closed) ranging from 43 miles in VCU 1315 to 192 miles in VCU 1420. Road densities in the project area WAAs would remain at 0.5 to 1.9 miles per square mile (Table WLD-29). Therefore no increase in human access would occur.

No small OGR modifications are proposed under Alternative 1. Values provided to black bears provided by the current OGRs are described in the affected environment section. Therefore there would be no associated effects to black bears.

Cumulative Effects

Alternative 1 would not harvest POG or result in additional roads, and therefore would not contribute to cumulative effects to black bears. Taking into account past, ongoing, and foreseeable projects Alternative 1 would reduce the amount of POG to 46 to 77 percent of the original (1954) POG within the project area WAAs (Table WLD-33). Although Alternative 1 would not contribute to the benefits of commercial thinning, pre-commercial thinning associated with the Tongass Pre-commercial Thinning (PCT) program and other forest restoration projects would benefit black bears through increased forage availability in young-growth stands.

Cumulative total road densities (all landownerships) in the project area WAAs would range from 1.2 to 2.4 miles per square mile (Table WLD-31). Alternative 1 would not contribute to an increase in harvest of bears.

Alternative 2

Direct and Indirect Effects

Under Alternative 2, approximately 4,962 total acres of POG would be harvested, resulting in a reduction of 2 to 5 percent from existing conditions depending on the WAA (Table WLD-32). This would result in a short-term increase in forage (berries) after harvest, but would decrease forage availability for bears over the long-term. Effects would be greatest in WAA 1420 followed by WAAs 1315/1319 and 1318, respectively. Although Alternative 2 would not contribute to the benefits of commercial thinning, pre-commercial thinning associated under the Tongass PCT program and other forest restoration projects would benefit black bears through increased forage availability.

Under Alternative 2, 32 miles of roads would be constructed and 18 miles would be reconstructed (Table 2-1). Road densities in the project area WAAs would range from 0.5 to 2.0 miles per square mile (Table WLD-29). Thus, Alternative 3 would only locally increase human access in the project area WAAs.

No small OGR modifications are proposed under Alternative 2. Therefore, there would be no associated effects to black bears.

Cumulative Effects

Under Alternative 2, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively maintain between 44 and 74 percent of the original (1954) POG within the project area WAAs (Table WLD-33). Thus, Alternative 2 may result in local declines in black bear carrying capacity, and thus in the black bear population over the long-term, due to reduced forage availability. Although Alternative 2 would not contribute to the benefits of commercial thinning, pre-commercial thinning associated with the Tongass PCT program and other forest restoration projects would benefit black bears through increased forage availability.

Cumulative total road density (all land ownerships) in the project area WAAs would range from 1.3 to 2.5 miles per square mile (Table WLD-31). Because all project area roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30), Alternative 2 would not be expected to substantially affect the harvest of black bears.

Alternative 3

Direct and Indirect Effects

Under Alternative 3, approximately 6,906 total acres of POG would be harvested, the most among the action alternatives, resulting in a reduction of 3 to 8 percent from existing conditions by WAA (Table WLD-32). This would result in a short-term increase in forage (berries) after harvest, but would decrease forage availability for bears over the long-term. However, thinning of approximately 2,299 acres under Alternative 3 would extend the time during which forage is available in young-growth stands for black bears.

Under Alternative 3, 52 miles of roads would be constructed and 38 miles would be reconstructed, the most among the action alternatives (Table 2-1). Road densities in the project area WAAs would range from 0.5 to 2.0 miles per square mile (Table WLD-29). Thus, Alternative 3 would only locally increase human access in the project area WAAs.

Small OGR modifications proposed under Alternative 3 would generally reduce connectivity to shoreline and riparian habitats preferred by black bears currently protected in OGRs. Modifications would result in a net decrease in stream miles included in small OGRs (27 miles) and in low-elevation POG included in the reserve system (2,736 acres). Values provided to black bears by the current OGRs are described in the affected environment section. Connectivity to beach, estuary, and shoreline habitats would continue to be provided by the Forest Plan conservation strategy.

Cumulative Effects

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of POG to between 43 and 72 percent of the original (1954) levels within the project area WAAs (Table WLD-33). Thus, Alternative 3 may result in local declines in black bear carrying capacity, and thus in the black bear population over the long-term, due to reduced forage availability. Commercial thinning under Alternative 3 would contribute to the beneficial effects to black bear habitat associated with ongoing and foreseeable young-growth management (PCT) and riparian thinning on NFS lands. Riparian thinning conducted under the Cobble Watershed (Ratz and Cobble creeks), Luck Creek/Eagle Creek, and North Thorne watershed restoration plans would improve black bear habitat in the VCUs where the small OGR modifications are proposed.

Cumulative total road density (all land ownerships) in the project area WAAs would range from 1.3 to 2.5 miles per square mile (WLD-31). Because all project area roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30), Alternative 3 would not be expected to substantially affect the harvest of black bears.

Alternative 4

Direct and Indirect Effects

Under Alternative 4, approximately 4,627 total acres of POG would be harvested, the least among the alternatives, resulting in a reduction of 2 to 5 percent from existing conditions by WAA (Table WLD-32). This would result in a short-term increase in forage (berries) after harvest, but would decrease forage availability for bears over the long term. However, thinning of approximately 1,888 acres under Alternative 4 would extend the time during which forage is available in young-growth stands for black bears.

Under Alternative 4, 11 miles of roads would be constructed and 20 miles would be reconstructed, the least among the action alternatives (Table 2-1). Road densities in the project area WAAs would range from 0.5 to 1.9 miles per square mile (Table WLD-29). With this minor increase, Alternative 4 would only locally increase human access in the project area WAAs.

Small OGR modifications under Alternative 4 would enhance connectivity to shoreline and riparian habitats preferred by black bears. Modifications would result in a net increase the miles of streams (29 miles) and miles of low elevation POG (2,684 acres) included in the reserve system. Habitat values provided to black bears by the current OGRs are described in the affected environment section. Connectivity to beach, estuary, and shoreline habitats would continue to be provided by the Forest Plan conservation strategy.

Cumulative Effects

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively reduce the amount to POG to between 44 and 73 percent of the original (1954) levels within the project area WAAs (Table WLD-33). Thus, Alternative 4 may result in local declines in black bear carrying capacity, and thus in the black bear population over the long-term, due to reduced forage availability. Commercial thinning under Alternative 4 would contribute to the beneficial effects (increased forage availability) to black bear habitat associated with ongoing and foreseeable young-growth management (PCT and riparian thinning) on NFS lands. Riparian thinning conducted under the Cobble Watershed (Ratz and Cobble creeks), Luck Creek/Eagle Creek, and North Thorne watershed restoration plans would enhance black bear habitat in the VCUs where OGR modifications are proposed.

Cumulative total road density in the project area WAAs would range from 1.2 to 2.4 miles per square mile (WLD-31). Because all project area roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30), Alternative 4 would not be expected to substantially increase harvest of black bears.

Alternative 5

Direct and Indirect Effects

Under Alternative 5, approximately 5,271 total acres of POG would be harvested, resulting in a reduction of 2 to 6 percent from existing conditions by WAA (Table WLD-32). Effects would range between Alternatives 2 and 3. This would result in a short-term increase in forage (berries) after harvest, but would decrease forage availability for bears over the long-term. However, thinning of approximately 1,850 acres under Alternative 5 would extend the time during which forage is available in young-growth stands for black bears.

Under Alternative 5, 15 miles of roads would be constructed and 17 miles would be reconstructed (Table 2-1). Road densities in the project area WAAs would range from 0.5 to 1.9 miles per square mile (Table WLD-29). With this minor increase, Alternative 5 would only locally increase human access in the project area WAAs.

No small OGR modifications are proposed under Alternative 5. Therefore there would be no associated effects to black bears.

Cumulative Effects

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of POG to between 43 and 73 percent of the original (1954) levels within the project area WAAs (Table WLD-33). Thus, Alternative 5 may result in local declines in black bear carrying capacity, and thus in the black bear population over the long term, due to reduced forage availability. Commercial thinning under Alternative 5 would contribute to the beneficial effects to black bear habitat associated with ongoing and foreseeable young-growth management (PCT and riparian thinning) on NFS lands.

Cumulative total road density in the project area WAAs would range from 1.2 to 2.4 miles per square mile (WLD-31). Because all project area roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30), Alternative 5 would not be expected to substantially increase harvest of black bears.

Conclusion

All of the action alternatives would reduce the amount remaining POG and increase road densities, with the greatest being under Alternative 3, followed by Alternatives 2, 5, 4, and 1 (Tables WLD-32 and WLD-33). The black bear habitat in GMU 2 is thought to be some of the highest quality in Southeast Alaska, particularly in the northern portion of Prince of Wales Island, including the project area WAAs (Wood 1990). However, over the long-term there is the potential for a decline in bear numbers as previously harvested stands (approximately 48,866 acres in the project area) move into the stem exclusion stage and forage availability is reduced (Porter 2008). Preferred habitats for black bears would continue to be protected on NFS lands by beach, estuary, and stream buffers, old-growth reserves, and other non-development LUDs.

Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper

Direct and Indirect Effects – All Alternatives

Timber harvest and associated activities under all action alternatives have the potential to disturb nesting adults and young, destroy nests, reduce habitat availability or cause nest abandonment. Because these species are year-round residents, timber harvest activities could also disturb and displace birds during the non-breeding season.

Direct effects to the red-breasted sapsucker, hairy woodpecker, and brown creeper would also result from the removal of nesting and foraging habitat (POG forest; Tables WLD-13 and WLD-15). These species rely on structural components (e.g., large diameter trees, snags) of the old-growth forest ecosystem for nesting and foraging. Red-breasted sapsuckers are most closely associated with low-volume old-growth; whereas hairy woodpeckers and brown creepers are associated with high-volume and large-tree, respectively. All harvest prescriptions and methods would reduce the number of large trees; however, uneven-aged and two-aged harvest would retain some structural components suitable for these species. It is assumed that alternatives that harvest more POG would have greater effects to these species.

Indirect effects to these species would be associated with fragmentation and the reduction in POG patch sizes (Table WLD-17). Fragmentation reduces the amount and effectiveness of interior forest habitat by creating habitat edges along which there may be increased rates of nest predation by avian predators (Kissling and Garton 2008).

Alternatives that result in the greatest increase in the number of patches in the smallest size classes, and result in the greatest decrease in acres of interior forest, would be expected to have greater effects to the red-breasted sapsucker, hairy woodpecker, and brown creeper.

Cumulative Effects – All Alternatives

Past timber harvest has reduced the amount of foraging and nesting habitat available in the project area for the red-breasted sapsucker, hairy woodpecker, and brown creeper by 33 percent (Table WLD-13). Fragmentation resulting from past timber harvest has also reduced patch sizes, decreasing the suitability of remaining habitat through the loss of interior forest conditions (Table WLD-17). All of the action alternatives would contribute to these effects (Table WLD-16). Ongoing and foreseeable timber harvest on NFS lands, including microsales and free use (albeit minor), and state lands would result in additional habitat loss and associated fragmentation. Young-growth treatments on NFS lands may provide additional foraging opportunities for cavity nesters through the increase in downed wood and decaying slash. Restoration activities that involve thinning would have similar effects. Under all alternatives, the Forest Plan conservation strategy would maintain habitats for these species.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects to red-breasted sapsucker, hairy woodpecker, and brown creeper because there would be no harvest of POG, large tree or low volume, and thus no changes in fragmentation or interior forest habitat would occur (Tables WLD-13, WLD-15, and WLD-34). The project area would continue to be influenced by natural disturbance processes (i.e., wind events, and landslides) which could create snag habitat for these species. Under Alternative 1 no commercial thinning would occur, and therefore there would be no potential benefits associated with the creation of conditions that promote snag development in younger stands.

No small OGR modifications are proposed under Alternative 1. Therefore, there would be no associated effects to cavity nesters.

Cumulative Effects

Alternative 1 would make no contribution to cumulative impacts to these species because no action (timber harvest or commercial thinning) would be undertaken. Under Alternative 1 past, ongoing, and foreseeable projects would collectively reduce the amount of total and large-tree POG to 66 and 59 percent of the original (1954) levels in the project area, respectively (Table WLD-16). The amount of low-volume POG would be reduced to 97 percent of the original levels under Alternative 1 (24,176 acres). Alternative 1 would result in a 6 percent cumulative increase in the number of POG patches (all size categories) and a 4 percent cumulative reduction in the amount of interior forest in the project area (Tables WLD-17 and WLD-34). Thus, populations of these species have likely declined to some extent in the project area, with resulting gaps in species distributions. No commercial thinning would occur but pre-commercial thinning on NFS lands would benefit these species by accelerating the development of large conifers that over time could provide suitable foraging and nesting habitat.

Alternative 2

Direct and Indirect Effects

Alternative 2 would harvest 4,962 acres of POG, including 1,383 acres of large-tree POG and 960 acres of low-volume POG reducing the amounts of these habitats currently available in the project area by 5, 6, and 4 percent, respectively (Tables WLD-13 and WLD-15). Alternative 2 would result in a 120 percent increase in the number of POG patches (all size categories) in the project area (Table WLD-17). Alternative 2 would reduce the amount of interior forest habitat in the project area by 3, 853 acres (7 percent; Table WLD-34). Therefore, Alternative 2 would locally reduce the amount of suitable nesting and foraging habitat available for these species. Under Alternative 2, no commercial thinning would occur, and therefore there would be no potential benefits associated with the creation of conditions that promote snag development in younger stands.

No small OGR modifications are proposed under Alternative 2. Therefore, there would be no associated effects to cavity nesters.

Table WLD-34. Direct and Cumulative Effects to Interior Forest by Alternative

Alternative	Direct Effects		Cumulative Effects	
	Acres of Interior Forest Remaining[1/]	Percent Reduction from 2012 (existing) Conditions	Acres of Interior Forest Remaining[1/]	Percent Reduction from 2012 (existing) Conditions
1	52,041	0	50,083	4
2	48,189	7	46,270	11
3	44,781	14	43,084	17
4	48,429	7	46,554	11
5	47,998	8	46,079	11

1/ Interior forest defined as POG and unproductive forest 600 ft (200 m) or farther from the edges of clearcuts and non-forest vegetation types.

Cumulative Effects

Under Alternative 2, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of total and large-tree POG to 63 and 55 percent of the original (1954) levels in the project area, respectively (Table WLD-16). The amount of low-volume POG would be reduced to 93 percent of the original levels under Alternative 2 (23,216 acres). Alternative 2 would result in a 126 percent cumulative increase in the number of POG patches (all size categories) and an 11 percent cumulative reduction in the amount of interior forest in the project area (Tables WLD-17 and WLD-34). The cumulative reduction in and fragmentation of nesting and foraging habitat under Alternative 2 could result in local declines in cavity nester populations due to reduced habitat availability, and thus in gaps in the distribution of these species. Pre-commercial thinning on NFS lands would benefit these species by accelerating the development of large conifers that over time could provide suitable foraging and nesting habitat.

Alternative 3

Direct and Indirect Effects

Alternative 3 would have the greatest effects to the red-breasted sapsucker, hairy woodpecker, and brown creeper among the alternatives. Alternative 3 would harvest 6,906 acres of POG, including 1,944 acres of large-tree POG and 1,154 acres of low-volume POG, reducing the amounts of these habitats currently available in the project area by 7, 9, and 5 percent, respectively (Tables WLD-13 and WLD-15). Alternative 3 would result in a 139 percent increase in the number of POG patches (all size categories) in the project area (Table WLD-17). Alternative 3 would reduce the amount of interior forest habitat in the project area 7,261 acres (14 percent; Table WLD-34). Therefore, Alternative 3 would reduce the amount of suitable nesting and foraging habitat available for these species. Under Alternative 3, commercial thinning in young-growth stands may create conditions that promote snag development in younger stands.

Small OGR modification proposed under Alternative 3 would increase the amount of suitable cavity nester habitat (total and /or large-tree POG) included within small OGRs in VCUs 5790, 5800, 5820, 5830 (total POG only), and 5950 (total POG only); modifications in VCUs 5810, 5830 (large-tree POG only), 5840, 5850, 5860, 5950 (large-tree POG only), and 5972 would decrease the amount of total and/or large-tree POG within the reserve system (Table OGR-2). Alternative 3 OGR modifications would result in a net decrease of 368 acres of interior forest habitat included in the OGR system.

Cumulative Effects

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of total and large-tree POG to 61 and 54 percent of the original (1954) levels in the project area, respectively, the greatest reduction among the alternatives (Table WLD-16). The amount of low-volume POG would be reduced to 92 percent of the original levels under Alternative 3 (23,022 acres). Alternative 3 would result in a 146 percent cumulative increase in the number of POG patches (all size categories) and a 17 percent cumulative reduction in the amount of interior forest in the project area (Tables WLD-17 and WLD-34).

The cumulative reduction in and fragmentation of nesting and foraging habitat could result in local declines in cavity nester populations due to reduced habitat availability, and thus in gaps in the distribution of these species. Commercial thinning under Alternative 3 may contribute to the beneficial effects resulting from other young-growth treatments and restoration activities on NFS lands that involved thinning would accelerate the development of large conifers that provide suitable foraging and nesting habitat for cavity nesters. Small OGR modifications under Alternative 3 would result in a net reduction of 843 acres of total POG, including 615 acres of large-tree POG, included in the small OGRs. These areas would become available for timber harvest and thus could result in additional habitat loss for cavity nesters, contributing to the effects of ongoing and foreseeable timber harvest projects.

Alternative 4

Direct and Indirect Effects

Alternative 4 would have the least effects to the red-breasted sapsucker, hairy woodpecker, and brown creeper among the alternatives. Alternative 4 would harvest 4,627 acres of POG, including 1,280 acres of large-tree POG and 781 acres of low-volume POG, reducing the amounts of these habitats currently available in the project area by 5, 6, and 3 percent, respectively (Tables WLD-13 and WLD-15). Alternative 4 would result in a 92 percent increase in the number of POG patches (all size categories) in the project area (Table WLD-17). Alternative 4 would reduce the amount of interior forest habitat in the project area by 3,613 acres (7 percent; Table WLD-34). Therefore, Alternative 4 would reduce the amount of suitable habitat available for these species. Under Alternative 4, commercial thinning in young-growth stands may create conditions that promote snag development in younger stands.

Small OGR modifications under Alternative 4 would increase the amount of total POG included in all project area small OGRs, and would increase the amount of large-tree POG in small OGRs in VCUs 5790, 5850, 5950, and 5960 (Table OGR-2). Alternative 4 OGR modifications would result in a net increase of 794 acres of interior forest habitat included in the OGR system. This would increase the amount of suitable cavity nester habitat maintained within the reserve system.

Cumulative Effects

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of total and large-tree POG to 63 and 56 percent of the original (1954) levels present in the project area, respectively, the smallest reduction among the action alternatives (Table WLD-16). The amount of low-volume POG would be reduced to 93 percent of the original levels under Alternative 4 (23,396 acres). Alternative 4 would result in a 98 percent cumulative increase in the number of POG patches (all size categories) and an 11 percent cumulative reduction in the amount of interior forest in the project area (Tables WLD-17 and WLD-34).

The cumulative reduction in and fragmentation of could result in local declines in cavity nester populations due to reduced habitat availability, and thus in additional gaps in the distribution of these species. Commercial thinning under Alternative 4 may contribute to the beneficial effects resulting from other young-growth treatments and restoration activities on NFS lands that involve pre-commercial or riparian thinning, which would accelerate the development of large conifers that provide suitable foraging and nesting habitat for cavity nesters. Small OGR modifications under Alternative 4 would result in a net increase of 2,029 acres of POG, including 475 acres of large-tree POG, maintained in small OGRs, which collectively would increase the amount of cavity nester habitat in the project area maintained in the reserve system.

Alternative 5

Direct and Indirect Effects

Alternative 5 would harvest 5,271 acres POG, including 1,374 acres of large-tree POG and 1,011 acres of low-volume POG, reducing the amount of these habitats currently available in the project area by 5, 6, and 4 percent, respectively (Tables WLD-13 and WLD-15). Effects of Alternative 5 rank between Alternatives 2 and 3. Alternative 5 would result in a 114 percent increase in the number of POG patches (all size categories) in the project area (Table WLD-17). Alternative 5 would reduce the amount of interior forest habitat in the project area by 4,043 acres (8 percent; Table WLD-34). Therefore, Alternative 5 would reduce the amount of suitable habitat available for these species. Under Alternative 5, commercial thinning in young-growth stands may create conditions that promote snag development in younger stands.

No small OGR modifications are proposed under Alternative 5. Therefore, there would be no associated effects to cavity nesters.

Cumulative Effects

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of total and large-tree POG to 62 and 55 percent of the original (1954) total and large-tree POG present in the project area, respectively (Table WLD-16). The amount of low-volume POG would be reduced to 92 percent of the original levels under Alternative 5 (23,165 acres). Alternative 5 would result in a 120 percent cumulative increase in the number of POG patches (all size categories) and an 11 percent cumulative reduction in the amount of interior forest in the project area (Tables WLD-17 and WLD-34).

The cumulative reduction in and fragmentation of could result in local declines in cavity nester populations due to reduced habitat availability, and thus in additional gaps in the distribution of these species. Commercial thinning under Alternative 5 may contribute to the beneficial effects resulting from other young-growth treatments and restoration activities on NFS lands that involve pre-commercial or riparian thinning, which would accelerate the development of large conifers that provide suitable foraging and nesting habitat for cavity nesters.

Conclusion

All action alternatives would reduce suitable cavity nesting habitat through the removal of POG forest, including large tree POG and fragmentation (reducing interior forest acres). Impacts would be greatest under Alternative 3, followed by Alternatives 5, 2, 4, and 1. Habitat for the red-breasted sapsucker, hairy woodpecker, and brown creeper would be maintained in the project area under the Forest Plan conservation strategy; however, small OGR modifications under Alternative 3 would reduce the amount of cavity-nester habitat (POG forest including snags and large trees) maintained within the reserve system that would become available for harvest.

Vancouver Canada Goose

Direct and Indirect Effects – All Alternatives

The Vancouver Canada goose nests and rears its broods in coastal forested habitats near water sources and winters along marine waters. This species uses both forested and un-forested wetlands. Forest Plan standards and guidelines that maintain theses habitats are beach and estuary buffers and riparian and lake buffers. Protection of wetlands and areas of concentrated waterfowl use is also provided for under the Waterfowl and Shorebird Habitat standards and guidelines; though there are no areas of concentrated waterfowl use identified in the project area.

Timber harvest and associated activities would have the potential to affect Vancouver Canada geese through noise and disturbance if activities occur in the vicinity of nest sites. Timber harvest and road building would also affect this species through the removal of forested wetlands. Conversion of these stands to young-growth would be expected to lower the ability of this habitat to support Vancouver Canada geese. It is assumed that alternatives that harvest the most forested wetlands would have the greatest effects to Vancouver Canada geese (Table WET-2).

Conversion of stands to young-growth as well as the conversion of the young growth to stem exclusion would be expected to lower the ability of this habitat to support Vancouver

Canada geese. Commercial thinning proposed to occur in Alternatives 3, 4 and 5 would help to mitigate the effects of timber harvest by reducing the time that the stands would be in stem exclusion stage.

Cumulative Effects – All Alternatives

Timber harvest in Vancouver Canada goose habitat has generally been minimal because these sites are fairly unproductive for timber harvest. Approximately 19 percent of the forested wetlands in the project area have been previously harvested or filled for road building (see Wetlands section of the FEIS for additional discussion; Table WET-2). The action alternatives would make minor contribution to these effects.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct or indirect effects to the Vancouver Canada goose because no action would be undertaken (Table WET-2).

Cumulative Effects

The conversion of previously harvested stands to stem exclusion would be expected to lower the ability of this habitat to support Vancouver Canada geese. Alternative 1 would make minimal contribution to cumulative effects to the Vancouver Canada goose because no action would be undertaken. Taking into account past, ongoing, and foreseeable projects, Alternative 1 would result in effects to 19 percent of the total forested wetlands in the project area (approximately 10,796 acres). No commercial thinning would occur under Alternative 1. Under Alternative 1, the Forest Plan conservation strategy would continue to maintain habitat for the Vancouver Canada goose.

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

Alternative 3 would affect the greatest amount of forested wetlands and thus the greatest effects to the Vancouver Canada goose among the alternatives (2,712 acres), followed by Alternative 5 (2,187 acres), Alternative 4 (1,817 acres), and Alternative 2 (1,774 acres). This represents 5, 4, 3, and 3 percent of the existing forested wetlands in the project area, respectively (Table WET-2; see the Wetlands section of the FEIS for additional discussion of wetland impacts). Thus, all alternatives would reduce the amount of habitat available for Vancouver Canada geese.

Commercial thinning in forested wetlands, proposed under Alternatives 3 (384 acres), 4 (350 acres), and 5 (349 acres) would have the potential to result in an additional, localized sources of noise and disturbance during implementation. However, commercial thinning would help to mitigate the effects of timber harvest by reducing the time that the stands would be in stem exclusion stage.

Cumulative Effects

Taking into account past, ongoing, and foreseeable projects, Alternative 3 would have the greatest cumulative effects to forested wetlands (24 percent of original forested wetlands impacted (approximately 13,535 acres), including impacts due to harvest and roads), followed by Alternative 5 (23 percent of original forested wetlands (13,009 acres), including impacts due to harvest and roads), and Alternatives 4 and 2 (22 percent of original forested wetlands (12,639 acres and 12,596 acres, respectively), including impacts due to harvest and roads; see the Wetlands section of the FEIS for additional discussion). Timber harvest, as well as commercial thinning conducted under Alternatives 3, 4, and 5, would contribute to noise and disturbance resulting from other ongoing and foreseeable projects within and near forested wetlands which could affect nesting geese. However, commercial thinning would contribute to the beneficial effects of other thinning projects in the project area and would reduce the time that the stands would be in stem exclusion stage. All activities on NFS lands would implement Forest Plan standard and guidelines which maintain habitat for this species.

Conclusion

All action alternatives would result in an additional reduction (3 to 5 percent) in Vancouver Canada goose habitat. Effects would be greatest under Alternative 3, followed by Alternatives 5, 2, 4, and 1. However, habitat for this species would be maintained by the Forest Plan conservation strategy.

Other Species of Concern

Marbled Murrelet

Direct and Indirect Effects – All Alternatives

Marbled murrelets nest in structurally complex old-growth forest stands (Piatt et al. 2006). As a result, timber harvesting and associated activities within POG forest stands (especially high-volume POG) can remove nest trees or disturb nesting birds. Alternatives that harvest the most POG and HPOG would have the greatest effect to murrelets (Tables WLD-13 and WLD-14). Indirectly, timber harvest and road building increase fragmentation, reducing the effectiveness of interior forest habitat and creating habitat edges along which there may be increased rates of nest predation by avian predators. Alternatives that harvest the most POG and result in the greatest increase in the number of small POG patches on the landscape would be expected to have the greatest direct and indirect effects to marbled murrelets (Tables WLD-13, WLD-14, and WLD-15). Under all alternatives, marbled murrelet nesting habitat would be protected by the Forest Plan conservation strategy. If marbled murrelet nests are discovered during project implementation, appropriate Forest Plan standards and guidelines would apply, including establishment of a nest buffer (WILD1.XVI.B).

Cumulative Effects – All Alternatives

Past timber harvest and associated activities have reduced the amount of suitable marbled murrelet nesting habitat (total and high-volume POG) to 67 and 58 percent of the original (1954) amount within the project area respectively (Tables WLD-13 and WLD-14). The action alternatives would contribute to these effects. Ongoing and foreseeable timber harvest on NFS and state lands would also remove nesting habitat and increase the level of fragmentation (decreasing the interior forest acres) on the landscape (Tables WLD-16 and WLD-34). Commercial thinning under Alternatives 3, 4, and 5, in combination with young-growth treatments and thinning projects (e.g., those conducted under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans) on NFS lands would improve marbled murrelet habitat over the long term by promoting stand development including large trees. Effects to nesting murrelets associated with activities on NFS lands would be minimized through the implementation of Forest Plan Marbled Murrelet standards and guidelines.

Alternative 1

Direct,Indirect, and Cumulative Effects

Alternative 1 would have no direct, indirect, or cumulative effects to the marbled murrelet because no action would be undertaken. Effects to total and high-volume POG and patch size, and the amount of interior forest in the project area, would be the same as described in the Red-breasted sapsucker, Hairy Woodpecker, and Brown Creeper subsection above (Tables WLD-13, WLD-14, WLD-16, WLD-17, and WLD-34).

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

All of the action alternatives would reduce the amount of suitable marbled murrelet nesting habitat in the project area and increase fragmentation. An analysis of total and high-volume POG harvest, POG patch creation and reduction in interior forest (fragmentation), and other effects to POG forests resulting from the alternative are described above in the Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper subsection. Effects would be greatest under Alternative 3, followed by Alternatives 2, 5, 4 (Tables WLD-13, WLD-14, WLD-17, and WLD-34). Small OGR modifications under Alternative 3 would generally reduce inclusion of marbled murrelet habitat in the reserve system (net reduction of 541 acres); whereas inclusion would increase with modifications proposed under Alternative 4 (net increase of 650 acres; Table OGR-2). The existing system of small OGRs would be maintained under Alternatives 2 and 5.

Cumulative Effects

Cumulative effects to POG and patch size in the project area by alternative are described above in the Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper subsection. The Big Thorne Project in combination with past, ongoing, and foreseeable projects would result in an additional reduction of 5 percent or less of the original (1954) total POG and an additional reduction of 6 percent or less of the original high-volume POG in the project area under any of the action alternatives, resulting in a cumulative reduction to 61 to 63 percent of 1954 levels for total POG and 52 to 54 percent of 1954 levels for high-volume POG (Table WLD-16). This would result in additional fragmentation (creating more patches and reducing the amount of interior forest habitat; Tables WLD-17 and WLD-34), with effects being greatest under Alternative 3, followed by Alternatives 2, 5, 4 and 1. Thus, Alternatives 2, 3, 4, and 5 may result in local declines in the marbled murrelet population due to the reduced availability of nesting habitat. However, under Alternatives 2, 4 (see Issue 2 discussion), and 5 the Forest Plan conservation strategy would continue to provide habitat for this species in the project area.

Conclusion

All the action alternatives have the potential to disturb nesting birds and would remove marbled murrelet nesting habitat. Effects would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1. Forest Plan standards and guidelines for nest buffers would be implemented under all alternatives which would minimize impacts to this species if a nest is discovered during project implementation.

Prince of Wales Flying Squirrel

Direct and Indirect Effects – All Alternatives

Prince of Wales flying squirrels are limited by their habitat requirements and dispersal capabilities. Densities of flying squirrels are linked to structural features common in POG forests such as large-diameter downed woody debris, snags, and tall trees (Smith et al. 2004) and abundance has been shown to be reduced by forestry practices that influenced the structure or age of residual stands (Smith et al. 2011). Additionally, due to their gliding locomotion, forest openings resulting from timber harvest can act as dispersal barriers if flying squirrels are not able to traverse openings (Flaherty et al. 2008, 2010; Smith et al. 2011). Fragmentation resulting from timber harvest has the potential to reduce the value of residual patches of old growth in the matrix if they become isolated from adjacent patches either by distance or habitat type (young growth). The duration of reduced habitat suitability following timber harvest depends in part on the time required for harvested stands to regenerate. Habitat suitability for flying squirrels would be expected to return more quickly under uneven-aged management (in 10-20 years), where some forest cover and structure are retained in the stand, than under even-aged management (in 60+ years; Holloway and Smith 2011).

Functional connectivity between OGRs, and its relationship to dispersal probability, is critical to the sustainability of Prince of Wales flying squirrel populations. At the landscape level, populations are sustained by the network of medium and large OGRs which support local source populations, interconnected by small OGRs which function as stepping stones between them (Smith et al. 2011).

All action alternatives would reduce the quality and quantity of flying squirrel nesting, foraging, and denning habitat in the project area but effects would be expected to be greatest under alternatives that propose the most POG harvest (Table WLD-13). Fragmentation would also increase under all action alternatives. Alternatives resulting in the greatest increase in the number of small POG patches would be expected to have the greatest effects to flying squirrels (Table WLD-17).

Commercial thinning proposed under Alternatives 3, 4, and 5 would benefit flying squirrels over the short term by increasing canopy height and creating more open space in the midstory, conditions which facilitate efficient gliding (Scheib et al. 2006). Over the long-term, commercial thinning would promote stand development toward conditions capable of supporting breeding flying squirrels and improve the functional connectivity between old-growth reserves (Smith et al. 2011).

Cumulative Effects – All Alternatives

Past timber harvest has reduced the amount of flying squirrel denning, nesting, and foraging habitat (POG) available in the project area VCUs by 33 percent (Table WLD-13). Fragmentation resulting from past timber harvest has also reduced patch sizes, decreasing the suitability of remaining habitat through the loss of interior forest conditions. All of the action alternatives would contribute to these effects. Ongoing and foreseeable timber harvest on NFS lands and state lands would result in additional habitat loss and associated fragmentation. The cumulative reduction in POG and connectivity (increase in number of POG patches on the landscape) within the matrix has the potential to isolate subpopulations of flying squirrels (Tables WLD-16 and WLD-17). Impacts would be greatest in VCUs where there has already been substantial past harvest, and large young-growth stands or large clearcuts (>0.6 mi or 1 km across) are already present which may act as barriers to flying squirrel movements. Young-growth treatments on NFS lands and restoration projects (i.e., those conducted under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans) that involve thinning, in combination with the commercial thinning proposed under Alternatives 3, 4, and 5, would improve habitat quality for flying squirrels creating structural conditions in young-growth stands that are conducive to flying squirrel dispersal (i.e., through which flying squirrels can glide). Activities on NFS lands would implement the Forest Plan conservation strategy which would maintain habitat for flying squirrels.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects to the Prince of Wales flying squirrel because no POG would be harvested; therefore resulting in no effect to habitat, patch size, fragmentation or connectivity. However, because no commercial thinning would occur under Alternative 1, managed stands would continue to grow slowly and would provide little suitable habitat for flying squirrels during the stem exclusion stage, which may last for 25 to 150 years. Under Alternative 1, the project area would continue to be subject to natural disturbances (i.e., windthrow), which would create gaps of various sizes over time. No small OGR modifications are proposed under Alternative 1. Based on the minimum reserve spacing suggested by Smith et al. (2011) of 0.6 mile (1 km) the existing functional connectivity within the project area would remain under Alternative 1 as follows:

§ Small OGRs in VCUs 5790, 5800, and 5840 would be functionally connected to each other and to the Honker large OGR complex via VCU 5780;

§ Small OGRs in VCUs 5950 would be functionally connected (only through its northeast corner through non-Federal land) to the Honker large OGR complex, and to the small OGR in VCU 5940;

§ Small OGRs in 5960 and 5972 would remain functionally connected to large reserves (Honker large OGR complex or Karta Wilderness);

§ Small OGRs in adjacent VCUs 5820/5830 and 5850/5860 would remain functionally connected to each other, but not to any larger reserve; and

§ The two pieces of the small OGR in VCU 5810 would remain functionally connected to each other through the stream buffer along Luck Creek and to a larger reserve through roadless acres, and the northern piece of the small OGR would remain functionally connected to the small OGR in VCU 5720.

Cumulative Effects

Under Alternative 1 past, ongoing, and foreseeable projects would collectively reduce the amount of POG to between 39 and 100 percent of the original (1954) levels within individual VCUs (Table WLD-16). Alternative 1 would result in a 6 percent cumulative increase in the number of POG patches on the landscape (Table WLD-17; see Biodiversity section for additional discussion). A summary of cumulative effects by VCU is provided in Table WLD-16. Although Alternative 1 would not involve commercial thinning, pre-commercial thinning conducted in the project area under the Tongass PCT program and thinning implemented under various watershed restoration plans (e.g., Cobble, Luck Creek/Eagle Creek, and North Thorne) would promote the development of suitable denning, nesting, and foraging habitat and facilitate flying squirrel movement through young-growth stands.

Alternative 2

Direct and Indirect Effects

Alternative 2 would maintain at least 85 percent of the POG currently available in the project area VCUs (Table WLD-13). Impacts by VCU are summarized in Table WLD-13. Effects would be greatest in VCUs 5950, 5972, and 5840 where the most harvest is proposed, reducing the existing POG in these VCUs by 10, 9, and 10 percent, respectively. Alternative 2 would result in a 120 percent increase in the number of POG patches (all size categories) on the landscape which would increase fragmentation and reduce connectivity (Table WLD-17). This would reduce the amount of habitat available for flying squirrels and may locally limit dispersal. Corridors between areas of past harvest would be affected by proposed harvest units in some cases (see the Wildlife and Subsistence Resource Report for a unit-by-unit discussion). No small OGR modifications are proposed under Alternative 2; therefore, the existing level of functional connectivity between reserves as described under Alternative 1 would be maintained.

Cumulative Effects

Under Alternative 2, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of POG to between 35 and 99 percent of the original (1954) levels within individual VCUs (Table WLD-16). A summary of cumulative effects by VCU is provided in Table WLD-16. Alternative 2 would result in a 126 percent cumulative increase in the number of POG patches on the landscape (Table WLD-17). Cumulative reductions in POG and connectivity within the matrix would further reduce the amount of suitable flying squirrel habitat, which may result in local declines in the flying squirrel population. Although Alternative 2 would not involve commercial thinning, pre-commercial thinning under the Tongass PCT program and thinning implemented under various watershed restoration plans (e.g., Cobble, Luck Creek/Eagle Creek, and North Thorne) would promote the development of suitable denning, nesting, and foraging habitat and facilitate flying squirrel movement through young-growth stands.

Alternative 3

Direct and Indirect Effects

Alternative 3 would maintain at least 85 percent of the POG currently available in the project area VCUs, having the greatest effects among the alternatives (Table WLD-13). Impacts by VCU are summarized in Table WLD-13. Effects would be greatest in VCUs 5950, 5972, and 5840 where the most harvest is proposed, reducing the existing POG in these VCUs by 12, 10, and 14 percent, respectively. Alternative 3 would result in a 139 percent increase in the number of POG patches in the project area (all size categories), the most among the alternatives, which would increase fragmentation and reduce connectivity (Table WLD-17). Corridors between areas of past harvest would be affected by proposed harvest units in some cases, more so than the other alternatives due to the greater number of harvest units and more clearcut prescriptions (see the Wildlife and Subsistence

Resource Report for a unit-by-unit discussion). This would reduce the amount of habitat available for flying squirrels and may locally limit dispersal. However, commercial thinning under Alternative 3 would promote forest conditions that facilitate flying squirrel movement through young-growth stands.

Small OGR modifications proposed under Alternative 3 would reduce functional connectivity for flying squirrels in the project area by increase the spacing between small OGRs in some VCUs. Based on the maximum reserve spacing suggested by Smith et al. (2011) of 0.6 mile (1 km), functional connectivity for flying squirrels would be as follows under Alternative 3:

- Small OGRs in 5960 and 5972 would remain functionally connected to large reserves (Honker large OGR complex and/or Karta Wilderness);
- Small OGRs in adjacent VCUs 5820/5830 and 5850/5860 would remain functionally connected to each other, but not to any larger reserve;
- Proposed modifications in the small OGR in VCU 5800, would disconnect the small OGRs in VCUs 5790, 5800, and 5840 from the Honker large OGR complex, though they would remain connected to each other;
- The northern small OGR in VCU 5810 would be disconnected from the small OGR in VCU 5720, but would now be functionally connected to the proposed northern, isolated portion of the small OGR in VCU 5820 (along the shoreline); The two pieces of the small OGR in VCU 5810 would remain functionally connected to each other through the stream buffer along Luck Creek and to a larger reserve through roadless acres; and
- The small OGR in VCU 5950 would be disconnected from the Honker large OGR complex due to the removal of OGR acreage (and addition of harvest units) along its northeast edge; however this OGR is already disconnected from the Honker due to State land.

Cumulative Effects

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of POG to between 34 and 96 percent of the original (1954) levels within individual VCUs (Table WLD-16). Alternative 3 would result in a 146 percent cumulative increase in the number of POG patches on the landscape (Table WLD-17). Alternative 3 would have the greatest cumulative effects among the alternatives. Cumulative reductions in POG and connectivity within the matrix would further reduce the amount of suitable flying squirrel habitat which may result in local declines in the flying squirrel population. However, commercial thinning under Alternative 3 would contribute to the beneficial effects associated with pre-commercial thinning under the Tongass PCT program and thinning implemented under various watershed restoration plans (e.g., Cobble, Luck Creek/Eagle Creek, and North Thorne), which would promote the development of suitable denning and nesting habitat and facilitate flying squirrel movement through young-growth stands.

Alternative 4

Direct and Indirect Effects

Alternative 4 would maintain at least 84 percent of the POG currently available in the project area VCUs, having the least effects along with Alternative 5 among the action alternatives (Table WLD-13). Impacts by VCU are summarized in Table WLD-13. Effects would be greatest in VCUs 5972, 5950, and 5840 where the most harvest is proposed, reducing the existing POG in these VCUs by 9, 8, and 9 percent, respectively. Alternative 4 would result in a 98 percent increase the number of POG patches (all size categories) in the project area which would increase fragmentation and reduce connectivity (Table WLD-17). Corridors between areas of past harvest would be affected by proposed harvest units in some cases, less so than the other action alternatives due to the fewer harvest units and more uneven-aged prescriptions, and because some units were dropped or modified under Alternative 4 to avoid effects to travel corridors (see the Wildlife and Subsistence Resource Report for a unit-by-unit discussion). This would reduce the amount of habitat available for flying squirrels and may locally limit dispersal. However, commercial thinning under Alternative 4 would promote forest conditions that facilitate flying squirrel movement through young-growth stands.

Small OGR modifications proposed under Alternative 4 would maintain or improve functional connectivity in the OGR network for flying squirrels in the project area by widening areas of functional connectivity and reducing the distances between small OGRs in some VCUs. Based on the maximum reserve spacing suggested by Smith et al. (2011), functional connectivity for flying squirrels would be as follows under Alternative 4:

- Small OGRs in adjacent VCUs 5820/5830 and 5850/5860 would remain functionally connected to each other, but not to any larger reserve;
- A connection to the Honker large OGR complex in VCU 5780 would be added to the network of small OGRs in VCUs 5790, 5800, and 5840;
- The northern small OGR in VCU 5810 would remain functionally connected to VCU 5720, but would also be functionally connected to the small OGR in VCU 5820 (along the shoreline to the proposed isolated northern piece of the small OGR in this VCU);
- The two pieces of the small OGR in VCU 5810 would remain functionally connected to each other through the stream buffer along Luck Creek and to a larger reserve through roadless acres;
- Small OGRs in VCUs 5950 and 5960 would remain functionally connected to the Honker large OGR complex and the Karta Wilderness, respectively, but the areas of connectivity would be widened; and
- The small OGR in VCU 5972 now be functionally connected to the small OGR in VCU 5960 (and through this VCU and roadless acres to the Karla Wilderness) and the Honker large OGR.

Cumulative Effects

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of POG to between 33 and 100 percent of the original (1954) levels within individual VCUs (Table WLD-16). A summary of cumulative effects by VCU is provided in Table WLD-16. Alternative 4 would result in a 98 percent cumulative increase in the number of POG patches on the landscape (Table WLD-17). Alternative 4 would result in the least cumulative effects among the action alternatives. Cumulative reductions in POG and connectivity within the matrix would further reduce the amount of suitable flying squirrel habitat which may result in local declines in the flying squirrel population. However, commercial thinning under Alternative 4 would contribute to the beneficial effects associated with pre-commercial thinning under the Tongass PCT program and thinning implemented under various watershed restoration plans (e.g., Cobble, Luck Creek/Eagle Creek, and North Thorne), which would promote the development of suitable denning and nesting habitat and facilitate flying squirrel movement through young-growth stands.

Alternative 5

Direct and Indirect Effects

Alternative 5 would maintain at least 84 percent of the POG currently available in the project area VCUs, the same Alternative 4 (Table WLD-13). Impacts by VCU are summarized in Table WLD-13. Effects would be greatest in VCUs 5972, 5950 and 5840 where the most harvest is proposed, reducing the existing POG in these VCUs by 9, 9, and 11 percent, respectively. Alternative 5 would result in a 114 percent increase in the number of POG patches (all size categories) in the project area which would increase fragmentation and reduce connectivity (Table WLD-17). Corridors between areas of past harvest would be affected by proposed harvest units in some cases, similar to Alternative 2 (see the Wildlife and Subsistence Resource Report for a unit-by-unit discussion). This would reduce the amount of habitat available for flying squires and may locally limit dispersal. However, commercial thinning under Alternative 5 would promote forest conditions that facilitate flying squirrel movement through young-growth stands.

No small OGR modifications are proposed under Alternative 5; therefore, the existing level of functional connectivity between reserves as described under Alternative 1 would be maintained.

Cumulative Effects

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of POG to between 33 and 97 percent of the original (1954) levels within individual VCUs (Table WLD-16). A summary of cumulative effects by VCU is provided in Table WLD-16. Alternative 5 would result in a 120 percent cumulative increase in the number of POG patches on the landscape (Table WLD-17). Cumulative reductions in POG and connectivity within the matrix would further reduce the amount of suitable flying squirrel habitat which may result in local declines in the flying squirrel population. However, commercial thinning under Alternative 5 would contribute to the beneficial effects associated with pre-commercial thinning under the Tongass PCT program and thinning implemented under various watershed restoration plans (e.g., Cobble, Luck Creek/Eagle Creek, and North Thorne), which would promote the development of suitable denning and nesting habitat and facilitate flying squirrel movement through young-growth stands.

Conclusion

All action alternatives would reduce suitable flying squirrel denning, nesting, and foraging habitat through the removal of POG forest and fragmentation. Effects to flying squirrels would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1. To some extent these effects would be mitigated through commercial thinning under Alternatives 3, 4 and 5 which would improve habitat suitability for flying squirrels in dense young-growth stands. The existing level of functional connectivity between reserves would be maintained under Alternatives 1, 2, and 5. However, small OGR modifications proposed under Alternative 3 may reduce functional connectivity among reserves in some VCUs; modifications proposed under Alternative 4 would maintain or improve functional connectivity for flying squirrels. Thus Alternatives 1, 2, 4, and 5 are more likely to continue facilitating back-and-forth exchange between source populations in larger reserves and small OGRs, whereas Alternative 3 has the potential to result in the isolation of local populations where functional connectivity is reduced. The Forest Plan conservation strategy maintains habitat for the Prince of Wales flying squirrel.

Prince of Wales Spruce Grouse

Direct and Indirect Effects – All Alternatives

Prince of Wales spruce grouse are associated with microhabitats within POG forests and therefore timber harvest would alter habitat availability for this species, though effects would change over time. Prince of Wales spruce grouse avoid young (less than 5 years) clearcuts presumably due to the presence of large amounts of debris that inhibit movement, increased exposure to predators, and lack of food; however, as the understory vegetation peaks after 15 to 25 years, grouse likely benefit from increased berry production and cover for chicks (Russell 1999). After this, forest conditions become unfavorable to spruce grouse, characterized by canopy closure, high stem densities, and little understory vegetation due to reduced light which reduces the overall structural and horizontal diversity of the stand. These conditions can persist up to 150 years after even-aged timber harvest. Thus, timber harvest under all action alternatives would have a short-term benefit to grouse due to increased forage availability, followed by an extended period in which habitat conditions in harvested units would not be suitable. Timber harvest could result in local reductions in spruce grouse density, though this effect would likely change over time with forest succession (Turcotte et al. 2000; USFWS 2010). It is assumed that alternatives that harvest the most POG would result in the greatest effects to spruce grouse (Table WLD-13). Commercial thinning under Alternatives 3, 4, and 5 would encourage structural and horizontal diversity beneficial to grouse in previously harvested stands. Under all alternatives, spruce grouse habitat would be maintained by the Forest Plan conservation strategy.

Due to their generally sedentary nature and preference for walking rather than flying, fragmentation due to timber harvest can result in the isolation of local spruce grouse populations. If patches of suitable habitat are spread too far apart (i.e., more than 1 mile; Russell 1999, Nelson 2010) for spruce grouse to move between, or if conditions in matrix lands between OGRs and other habitat reserves are not connected by suitable habitat they may become barriers to spruce grouse. This may reduce exchange between neighboring populations, making it difficult for isolated populations to recruit new breeders. It is assumed that alternatives that result in the greatest increase in number of patches on the landscape would have the greatest effects to spruce grouse (Table WLD-17).

Increased road densities associated with timber harvest could also adversely affect this species by increasing hunter access (USFWS 2010). Rabe (2009) concluded that Prince of Wales spruce grouse found in roaded areas are the most vulnerable to harvest, whereas birds in unroaded areas have little chance of being harvested. Road strike accounted for 17 to 22 percent of the mortalities of radio-marked birds in a study of grouse mortality on Prince of Wales Island, comparable to the level of hunter harvest (Nelson 2010). This is influenced in part by the fact that spruce grouse appear to use roads for dispersal (USFWS 2010). However, there is no known road density threshold for spruce grouse. Alternatives resulting in the greatest increase in road density would be expected to have the greatest potential to increase spruce grouse vulnerability to harvest (Table WLD-29). However, many of the remaining intact old-growth forests within the project area that provide suitable habitat for spruce grouse are maintained within OGRs as well as other non-development LUDs.

Cumulative Effects – All Alternatives

Timber harvest within Southeast Alaska has occurred disproportionately in the range of the Prince of Wales spruce grouse (USFWS 2010), reducing the availability of large, unfragmented patches of POG and resulting in an extensive road system. All of the action alternatives would cause additional habitat loss and fragmentation, contributing to these effects. Habitat loss and fragmentation would also occur in association with ongoing and foreseeable timber harvest on both NFS lands and lands in other ownerships. Cumulative effects to POG are presented in Table WLD-16.

Commercial thinning proposed under Alternatives 3, 4, and 5 would improve habitat suitability for spruce grouse within the matrix, as would foreseeable young-growth treatments on NFS lands and other watershed restoration plans that involve thinning (e.g., those implemented under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans).

All action alternatives would expand the road system in the project area; however, roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30), thus limiting the period in which spruce grouse harvest vulnerability would be expected to increase. Road closures under the Prince of Wales Island ATM would further reduce harvest and road kill vulnerability over the long term. Cumulative road densities at all elevations are presented in Table WLD-31.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effect to spruce grouse because no action would be undertaken. However, because commercial thinning would not occur under Alternative 1, there would be no associated benefits to grouse and structural diversity within previously harvested stands would develop slowly over time. The project area would also continue to be influenced by natural disturbance processes (i.e., periodic wind events, landslides) which have the potential to create gaps in the spruce grouse distribution. Alternative 1 would also not result in any change to road access and associated vulnerability to harvest for this species.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects to spruce grouse because no action would be undertaken. Under Alternative 1, commercial thinning would not occur and therefore there would be no associated benefits to grouse. Pre-commercial thinning under the Tongass PCT program and riparian thinning under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans would enhance the suitability of young-growth stands for spruce grouse.

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

Harvest of POG within VCUs and POG patch numbers by alternative are described in the Prince of Wales Flying Squirrel subsection above (Tables WLD-13 and WLD-17). Based on acres of POG harvested and the resulting number of POG patches, Alternative 3 would have the greatest effect to spruce grouse related to habitat loss and fragmentation, followed by Alternatives 2, 5, and 4.

Commercial thinning under Alternatives 3, 4, and 5 would encourage structural and horizontal diversity beneficial to grouse in previously harvested stands. Total road densities (NFS lands only at all elevations) by alternative are discussed in the Marten subsection above (Table WLD-29). Based on the increase in total road densities, Alternative 3 would have the greatest effect related to increased vulnerability to harvest along roads, followed by Alternatives 2, 4, and 5.

Small OGR modifications under Alternative 3 in VCUs 5790, 5840, 5850, 5860, and 5972 would reduce inclusion of the largest blocks of POG, thereby increasing the likelihood that they will become fragmented by timber harvest (Table OGR-2). Small OGR modifications under Alternative 4 would maintain or increase inclusion of the largest POG patches in all VCUs, except VCU 5972, which would maintain spruce grouse habitat (Table OGR-2).

Cumulative Effects

Cumulative effects to POG in the project area VCUs by alternative, taking into account past, ongoing, and foreseeable projects, are described above in the Prince of Wales Flying Squirrel subsection. Cumulative road densities are described in the Marten subsection. Thus, all alternatives would reduce the amount of habitat available to spruce grouse and may increase harvest risk along roads, which could lead to a local decline in the spruce grouse population. Based on cumulative reductions in POG and increases in road densities, cumulative effects to spruce grouse would be greatest under Alternative 3, followed by Alternatives 2, 5, and 4 (Tables WLD-16 and WLD-29).

Conclusion

All action alternatives would reduce suitable Prince of Wales spruce grouse habitat through the removal of POG forest and increased fragmentation. Based on acres of POG harvested, POG patches created, and road construction, effects to spruce grouse would be greatest under Alternative 3, followed by Alternatives 2, 5, 4 and 1. To some extent, these effects would be mitigated through commercial thinning under Alternatives 3, 4, and 5, which would encourage structural diversity in young-growth stands, increasing their suitability as spruce grouse habitat (Russell 1999).

Conservation measures including the system of OGRs and other non-development LUDs in addition to the standards and guidelines that maintain connectivity within matrix lands (e.g., various buffer requirements) that would be implemented under all alternatives would facilitate dispersal and interchange between spruce grouse populations. Small OGR modifications under Alternative 3 would decrease inclusion of the largest blocks of POG; inclusion of large blocks of POG would increase under Alternative 4.

All action alternatives would expand the road system in the project area; however, roads would be closed within 1 to 5 years of timber harvest (1 to 5 years after timber sale activities the roads will remain open to High Clearance Vehicles to allow for firewood removal and other incidental uses from May 1 to November 30), thus limiting the period in which spruce grouse harvest vulnerability would be expected to increase. Scheduled road closures under the Prince of Wales Island ATM would further reduce harvest and road kill vulnerability over the long term. The Forest Plan conservation strategy maintains habitat for the Prince of Wales spruce grouse.

Endemic Species

Direct and Indirect Effects – All Alternatives

Prince of Wales Island has been identified as a hotspot for endemism, and is also an area where there has been intensive past timber harvest (Cook et al. 2006). By definition, endemic species occur in isolated populations and many have limited mobility or specific habitat requirements. Thus they are vulnerable to the effects of habitat loss and fragmentation; introduced non-natives; pathogens and disease; natural events (i.e., climate change); and overharvesting (Dawson et al. 2007). Therefore, the ability to disperse and recolonize is an important factor in how endemic species are able to respond to environmental changes.

Timber harvest would directly affect endemic species by through habitat loss (POG) and fragmentation (reduced patch size), and by altering the distribution of habitats across the landscape. This may inhibit the ability of individuals to move between patches of suitable habitat, and therefore may further limit the distribution of a population or reduce genetic interchange between subpopulations. Effects to POG and fragmentation (POG patch size) are presented in Tables WLD-13 and WLD-17.

Road construction associated with timber harvest can fragment populations and increase human access to remote areas, thereby increasing the probability of overexploitation for some species (e.g., wolves and spruce grouse; Pearson et al. 1996, Russell 1999). With the exception of wolves, there are no known road density thresholds for any endemic species.

Effects to the Alexander Archipelago wolf, Alexander Archipelago black bear, Prince of Wales flying squirrel, and Prince of Wales spruce grouse are discussed in detail above. No direct or indirect effects to the Haida Gwaii ermine are anticipated under any of the alternatives because this species is associated with low elevation riparian and shoreline areas which would be protected by the Forest Plan conservation strategy. The alternatives analysis here focuses on the Keen's myotis, which is associated with large trees and snags present in POG (Boland et al. 2009).

Alternatives that harvest the most POG and result in the greatest increase in the number of smaller POG patches on the landscape would be expected to have the greatest effect to the Keen's myotis (Tables WLD-13 and WLD-17). This may reduce the number of suitable roost trees for bats; however, it should be noted that roost trees for Keen's myotis do not appear to be limited on Prince of Wales Island, and bats may choose a large-diameter tree for roosting regardless of whether or not it is located in an area with past timber harvest (Boland et al. 2009). Commercial thinning proposed under Alternatives 3, 4, and 5 would benefit this species by promoting more rapid development of larger trees in young-growth stands. Habitat and landscape connectivity would be provided for this species by the Forest Plan conservation strategy.

Cumulative Effects – All Alternatives

Past timber harvest has reduced the amount of POG habitat available for the Keen's myotis. Timber harvest proposed under the action alternatives would further reduce and fragment POG habitat, and could reduce the number of forested flyways used for bats commuting between foraging and roosting areas. Additional habitat loss and fragmentation would occur in association with ongoing and foreseeable timber harvest on NSF lands and lands in other ownerships (Table WLD-16). Commercial thinning proposed under Alternatives 3, 4, and 5, in combination with young-growth treatments on NSF lands and restoration projects that involve thinning (e.g., those implemented under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans) would promote stand development and increase habitat availability for this species over the long term.

The Forest Plan conservation strategy was designed to address effects to endemic species through the network of OGRs and other non-development LUDs and Forest-wide standards and guidelines which were intended to maintain habitat components important to a variety of species and maintain connectivity across the landscape.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects to the Keen's myotis because no action would be undertaken. Indirectly, without commercial thinning, managed stands would continue to grow slowly and would provide little structural diversity suitable for roosting during the stem exclusion stage, which may last for decades. Over time, natural events (i.e., windthrow) would continue to alter the forest and create roosting habitat.

No small OGR modifications would occur under Alternative 1. Therefore, there would be no related effects to the Keen's myotis.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects to the Keen's myotis because no action would be undertaken. Under Alternative 1 past, ongoing, and foreseeable projects would collectively maintain between 39 and 100 percent of the original (1954) POG in the project area VCUs (Table WLD-16). Young-growth management activities on NFS lands would promote stand development.

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

Productive old-growth harvest by VCU and changes in POG patch numbers by alternative are described in the Prince of Wales Flying Squirrel subsection above (Tables WLD-13 and WLD-17). Timber harvest would remove POG, thereby reducing the number of potential day-roosts available to bats, a critical resource for this forest-dwelling species (Boland et al. 2009). Indirectly, timber harvest may also reduce the suitable remaining roosting habitat through increased fragmentation (and decreased patch sizes) as day-roosts are more likely to be selected if they are located in stands with a higher number of trees in early to late decay stages (Boland et al. 2009). However, Boland et al. (2009) concluded that roost sites do not appear to be limited on Prince of Wales Island.

Alternative 3 would have the greatest effect to the Keen's myotis related to habitat loss and fragmentation, followed by Alternatives 2, 5, and 4. However, under all alternatives effects would be minor given that roost sites are not a limiting factor on Prince of Wales Island. Commercial thinning under Alternatives 3, 4, and 5 would accelerate the development of trees capable of providing roosting habitat and improve landscape connectivity.

Small OGR modification proposed under Alternative 3 would increase the amount of suitable Keen's myotis roosting habitat (POG) included in small OGRs in VCUs 5790, 5800, 5820, 5830, and 5950; modifications in VCUs 5810, 5840, 5850, 5860, and 5972 would decrease the amount of POG included (Table OGR-2). Small OGR modifications under Alternative 4 would increase the amount of suitable Keen's myotis roosting habitat maintained within the reserve system in all project area small OGRs (Table OGR-2). No small OGR modifications would occur under Alternative 2 and 5. Therefore, there would be no related effects to the Keen's myotis.

Cumulative Effects

Cumulative POG harvest by VCU is discussed in the Prince of Wales Flying Squirrel subsection above (Table WLD-16). Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would result in the greatest cumulative reduction in the amount of original (1954) POG and therefore the least habitat for the Keen's myotis, followed by Alternatives 2, 5, and 4. Moreover, small OGR modifications under Alternative 3 would result in a net reduction of 843 acres of POG maintained in small OGRs. These areas would become available for timber harvest and thus could result in additional loss of roosting habitat, as well as forested travel corridors, for the Keen's myotis, contributing to the effects of ongoing and foreseeable timber harvest projects. Alternatively, small OGR modifications under Alternative 4 would result in a net increase of 2,029 acres of POG maintained in small OGRs, which would provide greater protection of roosting habitat.

Conclusion

Based on POG harvest and increase in number of patches on the landscape, effects to the Keen's myotis would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and

1. All action alternatives would increase the risk of reducing forested corridors (see discussion in POW flying squirrel) that would facilitate movement of bats across the landscape. The Forest Plan conservation strategy maintains habitat for endemics.

Migratory Birds

Direct and Indirect Effects – All Alternatives

Direct effects to migratory birds would result from disturbances that disrupt breeding birds, remove active bird nests, or cause nest abandonment. For species that are year-round residents, timber harvest (POG removal) and associated activities (road building) have the potential to disturb and displace birds during the non-breeding season. Indirect effects would result from the reduction of perching, foraging, and potential nesting habitat and the increase in fragmentation. After timber harvest there would be a short-term increase in the habitat for species associated with early successional habitats and forest edges, which may result in short-term population growth for these species. However, extended local reductions in available habitat would be expected as forest succession progresses.

Habitat fragmentation can strongly influence bird community composition and bird distribution and has been identified as a major cause of population declines of breeding migratory songbirds (DellaSala et al. 1996; Manuwal and Manuwal 2002). Habitat removal would reduce the effectiveness of interior forest habitat, and increase the potential for nest predation and nest parasitism for some species, which can ultimately reduce reproductive success (Robinson et al. 1995). Migratory birds would be most susceptible to impacts from harvest activities occurring in suitable nesting habitat during the nesting/fledging period, which generally begins in mid-April and ends about mid-July, when young birds have fledged.

The migratory bird species most likely to be adversely affected by the project are those that primarily nest in POG forests, including the Western screech-owl, rufous hummingbird, red-breasted sapsucker, Pacific-slope flycatcher, Steller's jay, northwestern crow, chestnut-backed chickadee, golden-crowned kinglet, varied thrush, Townsend's warbler, blackpoll warbler, northern goshawk and marbled murrelet. Therefore, the discussion here focuses on old-growth associated species. Alternatives that harvest more POG and result in greater increases in the number of POG patches on the landscape would be expected to have greater effects to these migratory bird species (Tables WLD-13 and WLD-17). However, species associated with early successional or scrub habitats such as the MacGillivray's warbler, golden-crowned sparrow, and golden-crowned kinglet would benefit through increases in suitable habitat over the short- to mid-term from timber harvest.

Effects to migratory birds can be minimized by altering the season of activity, retaining snags, maintaining the integrity of breeding sites, considering key winter and migration areas, and minimizing pollution or detrimental alteration of habitats (USDA Forest Service 2008c). Under all alternatives, migratory bird habitat would be maintained by the Forest Plan conservation strategy.

Cumulative Effects – All Alternatives

Past timber harvest in the project area has removed migratory bird habitat or reduced its suitability through fragmentation (and associated edge effects such as predation). The action alternatives would contribute to the loss and fragmentation of migratory bird habitat. However, the action alternatives would contribute to increased fragmentation (reducing interior forest acres) and reduction in POG habitats (Tables WLD-16 and WLD-17); however, migratory bird habitat would be maintained by the Forest Plan conservation strategy. Commercial thinning under Alternatives 3, 4, and 5, in combination with other young-growth treatment on NFS lands and watershed restoration activities that involve thinning, would collectively improve habitat conditions for old-growth associated migratory birds; though over the long term, these stands would become available for harvest again.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no adverse direct and indirect effects to migratory birds because no timber or associated activities would occur. Therefore there would be no reduction in POG habitat or interior forest acres or increase fragmentation. Alternative 1 would not have the beneficial effects of young-growth management which would increase the suitability of these stands for old-growth associated migratory birds. Overtime, previously harvested stands would continue to grow slowly and would provide little forage or structural diversity for migratory birds during the stem exclusion stage, which may last for decades. No small OGR modifications would occur under Alternative 1; therefore, there would be no associated effects to migratory birds.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects to migratory birds because no timber would be harvested. Under Alternative 1, past, ongoing, and foreseeable projects would collectively reduce the amount of POG to between 39 and 100 percent of the original (1954) levels within the project area VCUs (Table WLD-16). Alternative 1 would result in a 6 percent cumulative increase in the number of POG patches on the landscape (Table WLD-17). Although Alternative 1 would not contribute to the potential benefits of commercial thinning associated with improving habitat suitability for migratory birds, these effects would occur in association with PCT under the Tongass PCT program, as well as thinning conducted under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans.

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

Productive old-growth harvest in the project area and associated changes in the number of POG patches (fragmentation) by alternative are discussed in the Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper subsection above (Tables WLD-13 and WLD 17). Effects to most migratory birds related to habitat loss and fragmentation would be greatest under Alternative 3, followed by Alternatives 2, 5, and 4. However, these effects would be mitigated to some extent by commercial thinning under Alternatives 3, 4, and 5, which has the potential to improve long-term habitat suitability for migratory birds by accelerating stand development, and associated potential foraging, roosting, and potentially nesting habitat. These beneficial effects would not occur under Alternative 2 which does not involve thinning.

Direct and indirect effects of small OGR modifications proposed under Alternatives 3 and 4 to migratory birds (inclusion of POG) would be comparable to those described under Endemics. No modifications are proposed under Alternatives 2 and 5.

Cumulative Effects

Cumulative POG harvest within the project area is discussed in the Red-breasted Sapsucker, Hairy Woodpecker, and Brown Creeper subsection above. Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would result in the greatest cumulative reduction in the amount of original (1954) POG and increase in the number of POG patches on the landscape, followed by Alternatives, 2, 5, and 4 (Tables WLD-16 and WLD-17). This would locally reduce habitat for migratory bird species associated with POG habitats. Migratory bird species associated with early seral and scrub habitats would benefit over the short-term from ongoing and foreseeable timber harvest projects. Alternatives 3, 4, and 5 would contribute to the potential beneficial effects to old-growth associated migratory birds of commercial thinning associated with stand development resulting from PCT under the Tongass PCT program, as well as thinning conducted under the Cobble, Luck Creek/Eagle Creek, and North Thorne watershed restoration plans. Cumulative effects of small OGR modifications under Alternatives 3 and 4 to migratory birds (inclusion of POG) would be comparable to those described under Endemics.

Conclusion

All action alternatives would reduce foraging and nesting habitat for old-growth associated migratory birds and increase fragmentation; however, effects would be localized and would not preclude migratory birds from using the project area. Species associated with early successional and scrub habitats would experience short-term benefits from timber harvest. Birds may be displaced if project activities occur during the nesting season. Impacts would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1.

Threatened, Endangered, Candidate, and Sensitive Species

A preliminary determination was made to assess the effects of the project on threatened, endangered, candidate, and sensitive species. A detailed analysis of effects to each species is provided in the project BA/BE and summarized in Table WLD-35. None of the alternatives would adversely affect listed species or their habitats, nor would they be likely to result in a trend toward Federal listing or a loss of viability for any sensitive species. The Forest Service is currently undergoing informal ESA Section 7 consultation with the NMFS for species with a “may affect” determination. A detailed analysis of effects to the Queen Charlotte goshawk is provided below.

Queen Charlotte Goshawk

Direct and Indirect Effects – All Alternatives

The Big Thorne Project has the potential to directly adversely affect goshawks through activities that create noise or disturb adults or young, resulting in the temporary displacement of individual birds, removal of active nests, or nest abandonment. There are no known goshawk nests within any of the proposed harvest units; therefore none of the alternatives would directly impact known actively nesting birds. Goshawks are year-round residents in the project area; therefore, timber harvest and associated activities could disturb or temporarily displace birds during the non-breeding season. Indirect effects of the Big Thorne Project include the reduction of perching, foraging, and potential nesting habitat (POG).

Impacts to goshawks are assessed in terms of the reduction in total and high-volume POG, which provides potential high quality nesting and foraging habitat. High-volume POG represents optimal nesting habitat due to the presence of large-trees and snags. Reductions in forest cover, and the subsequent progression of forest succession in second-growth stands, also have the potential to affect the abundance and availability of prey. This may cause goshawks foraging in the North Central Prince of Wales Island biogeographic province to increase their breeding home range size in order to gather sufficient prey to raise young (McClaren 2004; Bloxton 2002). Additionally, if timber harvest reduces the proportion of the landbase consisting of POG and mature second-growth forest to below 50 percent (based on the minimum range of 40 to 60 percent thought to be favorable for goshawks; see Affected Environment discussion), this could result in portions of the landscape becoming marginal or unsuitable for goshawks. Therefore, alternatives that harvest the most POG, and reduce the proportion of the landscape consisting of mature young-growth and old-growth forest to be low 50 percent, would be expected to have the greatest effect on goshawks (Table WLD-35). It should be noted that there is a low abundance of goshawks on POW due to the lack of prey.

Uneven-aged and two-aged (Alternative 4 only) harvest prescriptions and legacy retention, which leave a proportion of the trees standing in the harvest unit, would maintain some habitat value for goshawks following harvest, provided that the trees with branches adequate to support goshawk perching are retained (Deitrich and Woodbridge 1994; Table WLD-23). Widen (1997) concluded that fragmentation of mature forest patches reduced goshawk hunting opportunities where remaining patches were surrounded by young-growth forests; therefore, uneven-aged harvest also may reduce the effects of fragmentation by retaining more structure adjacent to unharvested stands.

Commercial thinning, proposed under Alternatives 3, 4, and 5 would enhance goshawk habitat and habitat for some goshawk prey by promoting stand development. Young-growth management would accelerate the growth of individual trees, reducing the age at which harvested stands would become useful again to goshawks (USFWS 2007b). Stands selected for treatment currently provide marginal goshawk habitat because they consist of high densities of small diameter trees, factors which limit availability of goshawk prey species and goshawk maneuverability (Salafsy et al. 2007).

Under all alternatives, goshawk habitat is maintained by the Forest Plan conservation strategy. If a new nest were located during the course of the project, Forest Plan standards and guidelines for goshawk nest protection would apply.

Table WLD-35. Summary of Effects Determinations for Threatened, Endangered, Candidate, and Sensitive Species

Common Name / *Scientific Name*	Status	Effects Determination[2/]	Effects Summary/Rationale for Determination
Species Under USFWS Jurisdiction			
Yellow-billed loon *Gavia adamsii*	ESA Candidate; Forest Service sensitive	May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing	• Potential for exposure to oil / fuel spills associated with use of MAFs and the transport of logs. • Species occurs at very low densities near the project area; very few individuals would be at risk. • Vessels would operate at infrequent intervals.
Species Under NMFS Jurisdiction			
Humpback Whale *Megaptera novaeangliae*	Endangered	Not likely to adversely affect	• Potential for exposure to vessel traffic and oil/fuel spills associated with the use of marine access facilities (MAFs) and the transport of logs; • Potential for vessel collisions. • Species are transient, and vessels would operate at low, constant speeds and infrequent intervals. • Measures would be taken to reduce impacts from disturbances and risk of collisions (i.e., preventing vessels from approaching marine mammals, and adhering to Forest Plan Standards and Guidelines, MMPA, and ESA). • All project activities would be conducted in accordance with Alaska Water Quality Standards for log transfer facilities (LTFs), limiting effects to water quality.
Steller sea lion – Eastern DPS / Western DPS *Eumetopias jubatus*	Threatened / Endangered	Not likely to adversely affect	
Chinook salmon *Oncorhynchus tshawytscha*	Threatened or Endangered depending on run	Not likely to adversely affect	• Potential for exposure to oil / fuel spills associated with use of MAFs and the transport of logs. • Potential for reductions in water quality and indirect impacts to benthic prey due to bark accumulations near LTFs. • Species may be present but are transient; not likely to occur near any project related activity. • All project activities will be conducted in accordance with Alaska Water Quality Standards for LTFs, limiting effects to water quality.
Sockeye salmon *Onchorhynchus nerka*		Not likely to adversely affect	
Steelhead *Oncorhynchus mykiss*		Not likely to adversely affect	
Coho salmon *Oncorhynchus kisutch*			

Table WLD-35. Summary of Effects Determinations for Threatened, Endangered, Candidate, and Sensitive Species (continued)

Common Name / *Scientific Name*	Status	Effects Determination[2/]	Effects Summary/Rationale for Determination
Alaska Sensitive Species			
Pacific herring *Clupea pallasii*	Forest Service Sensitive; ESA Candidate	May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing	• Potential for exposure to oil/fuel spills associated with use of MAFs and the transport of logs. • Vessels would operate at infrequent intervals • Forest Plan standards and guidelines and BMPs would be implemented to maintain water quality • All project activities would be conducted in accordance with Alaska Water Quality Standards for LTFs, limiting effects to water quality
Queen Charlotte goshawk *Accipiter gentilis laingi*	Forest Service Sensitive	May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing	• Potential for noise and disturbances. • Removal of POG would decrease available nesting and foraging habitat; local expansion of individual goshawk home ranges possible, potentially leading to a local reduction in breeding density. • Species is highly mobile and breeding density is already low due to existing levels of timber harvest. • Forest Plan standards and guidelines for protection of known active nests applied.
Black oystercatcher *Haematopus bachmani*	Forest Service Sensitive	May adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing	• Potential for exposure to oil / fuel spills associated with use of MAFs and the transport of logs. • Species occurs at very low densities near the project area; very few individuals would be at risk. • Vessels would operate at infrequent intervals.

1/ "Yes" if the species is known or is likely to occur, or its habitat occurs, in the project area or in marine waters adjacent to the project area. "No" if the species has not been documented or is not likely to occur in the Analysis Area.
2/ Determinations for threatened and endangered species include "no effect (NE)," "not likely to adversely affect (NLAA)," or "likely to adversely affect (LAA)" (Bosch 2004). Candidate species are treated as Forest Service sensitive species (Goldstein et al. 2009). Determinations for sensitive species include "no impacts", "beneficial impacts", "may impact individuals but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing," or "likely to result in a loss of viability in the Planning Area, or in a trend toward Federal listing" (FSM 2672.42 September 2005).

Cumulative Effects – All Alternatives

Timber harvest since 1954 has increased fragmentation of productive forest habitat and reduced the amount of high-quality habitat within the North Central Prince of Wales biogeographic province, which has experienced more harvest than other portions of the Tongass National Forest. Taking all land ownerships into account, the approximately 49 percent of the original total POG and 59 percent of the original high-volume POG present in 1954 will have been harvested (or removed by natural means such as blowdown) in the North Central Prince of Wales biogeographic province after full implementation of the Forest Plan (Table WLD-16). Within individual VCUs, the amount of original total POG remaining ranges from 39 to 100 percent; the amount of original high-volume POG remaining ranges from 18 to 100 percent (Table WLD-16). Refer to the biodiversity analysis above for a detailed discussion of effects to POG. Ongoing and future timber harvest on NFS and state and private lands (e.g., Logjam, Roadside EA, and Alaska State DNR timber sales) would result in additional loss of old-growth forest. However, commercial thinning under Alternatives 3, 4, and 5 in combination with future young-growth treatment and other thinning projects on NFS lands will, over the long-term, enhance goshawk habitat.

Foraging goshawks could be temporarily disturbed or displaced by timber harvest activities associated with the Big Thorne Project; similar disturbance also has the potential to occur in association with the other timber harvest, restoration, and ongoing road maintenance activities listed in Chapter 2. Minor short-term cumulative effects to goshawks may occur if the noise or disturbance associated with these activities and the Big Thorne Project coincide.

Alternative 1

Direct and Indirect Effects

Alternative 1 would have negligible effects to goshawks because no action would be undertaken. Existing amounts of total POG and high-volume POG would remain (Tables WLD-13 and WLD-14). The seven VCUs that currently maintain at least 50 percent cover of POG and mature young-growth forest would continue to do so under Alternative 1 (Table WLD-36). No small OGR modifications would occur under Alternative 1; therefore, there would be no related effects to the goshawk.

Cumulative Effects

Alternative 1 would not contribute to cumulative effects to goshawks as no action would be undertaken. Refer to the Biodiversity section for an analysis of cumulative effects to total and high-volume POG within the North Central Prince of Wales biogeographic province and by VCU under Alternative 1 (Table WLD-16). Alternative 1 in combination with past, ongoing, and foreseeable projects would maintain seven VCUs with at least 50 percent cover of POG and mature young-growth forest (Table WLD-37).

Alternative 2

Direct and Indirect Effects

Alternative 2 would harvest 4,962 acres of POG and 2,621 acres of high-volume POG, the third highest amount among the alternatives, which would reduce potential goshawk habitat (Tables WLD-13 and WLD-14). Approximately 24 percent of harvest would be uneven-aged under Alternative 2, thus most units would retain little value to goshawks following harvest (Table WLD-23). Refer to the biodiversity analysis for a discussion of effects to POG within the biogeographic province and by VCU. Of the seven VCUs which currently maintain at least 50 percent cover of POG and mature young-growth forest, six would continue to do so under Alternative 2 (Table WLD-36). The proportion of VCU 5800 consisting of POG and mature young-growth forest would decline from 50 to 48 percent, potentially resulting in a minor reduction in the suitability of this landscape for goshawk foraging and nesting. Under Alternative 2, the project area as a whole would continue to provide marginal goshawk foraging and nesting habitat, maintaining 44 percent of the landbase in POG and mature young-growth forest (Table WLD-36).

No small OGR modifications would occur under Alternative 2; therefore, there would be no related effects to the goshawk.

Cumulative Effects

Within the project area VCUs, Alternative 2 in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of total POG to 35 to 99 percent of the original levels and the amount of high-volume POG to 16 to 99 percent of the original (1954) levels (Table WLD-16). Refer to the Biodiversity discussion for an analysis of cumulative effects to POG within the North Central Prince of Wales biogeographic province and by VCU under Alternative 2. Alternative 2 in combination with past, ongoing, and foreseeable projects would maintain six VCUs with at least 50 percent cover of POG and mature young-growth forest, one less than under Alternative 1 (Table WLD-37). Thus, Alternative 2 has the potential to result in a local reduction goshawk nesting and foraging habitat, and in the goshawk prey base. This could result in a reduction in the density of goshawks in the project area VCUs.

Table WLD-36. Landscape Composition Resulting from the Alternatives

VCU	Landscape Composition (Percent of Landbase Below Treeline)[1,2/,3/]																			
	Alternative 1				Alternative 2				Alternative 3				Alternative 4				Alternative 5			
	POG and Mature Young-growth	Young Young-growth	Unproductive Forest	Non-forested	POG and Mature Young-growth	Young Young-growth	Unproductive Forest	Non-forested	POG and Mature Mature-growth	Young Young-growth	Unproductive Forest	Non-forested	POG and Mature Young-growth	Young Young-growth	Unproductive Forest	Non-forested	POG and Mature Young-growth	Young Young-growth	Unproductive Forest	Non-forested
5720	42	34	10	13	42	34	10	13	42	34	10	13	42	34	10	13	42	34	10	13
5740	56	14	12	18	56	14	12	18	56	14	12	18	56	14	12	18	56	14	12	18
5750	66	3	17	14	66	3	17	14	66	3	17	14	66	3	17	14	66	3	17	14
5760	51	4	27	19	50	4	27	19	50	4	27	19	51	4	27	19	50	4	27	19
5780	56	19	9	16	52	21	10	17	52	21	10	17	53	21	10	17	53	21	10	17
5790	28	50	12	10	25	52	13	10	25	51	13	11	25	51	13	11	25	51	13	11
5800	50	28	11	12	48	29	11	12	46	30	11	13	48	29	11	12	48	29	11	12
5810	34	45	10	11	32	46	10	12	32	45	10	12	33	44	10	12	34	44	10	12
5820	77	2	13	9	77	2	13	9	75	2	14	9	77	2	13	9	76	2	13	9
5830	56	23	11	11	53	24	11	12	53	24	11	12	53	24	12	12	52	25	11	12
5840	45	35	13	7	42	37	14	7	43	35	15	7	44	35	14	7	43	35	14	7
5850	29	44	17	10	27	46	18	10	26	46	18	10	27	45	18	10	26	46	18	10
5860	42	45	7	7	40	45	7	8	41	45	7	8	41	44	7	8	41	45	7	8
5950	35	28	22	15	32	29	23	15	32	29	24	16	33	29	23	15	33	29	23	15
5960	44	2	33	21	44	2	33	21	44	2	33	21	44	2	33	21	44	2	33	21
5971	47	9	24	20	46	9	24	20	46	9	24	20	47	9	24	20	46	9	24	20
5972	39	25	22	14	37	26	23	15	38	24	23	15	37	24	23	15	38	24	23	15
5980	44	22	23	10	44	22	23	10	44	22	23	10	44	22	23	10	44	22	23	10
Project Area	46	24	16	13	44	25	17	14	44	25	17	14	45	24	17	14	45	25	17	14

1/ Landbase includes areas below tree line, defined as all areas below 1,500 ft elevation

2/ Totals may not add up due to rounding.

3/ Mature young-growth includes natural and harvested young-growth stands 50 years old or older. This is the minimum age at which suitable structure for nesting goshawks may be achieved (McClaren 2003).

Table WLD-37. Cumulative Effects to Landscape Composition by Alternative

VCU	Original (1954) % POG and Mature Young-growth	Landscape Composition (Percent of Landbase Below Treeline[1/]) [2/, 3/]																			
		Alternative 1				Alternative 2				Alternative 3				Alternative 4				Alternative 5			
		POG and Mature Young-growth	Young Young-growth	Unproductive Forest	Non-forested	POG and Mature Young-growth	Young Young-growth	Unproductive Forest	Non-forested	POG and Mature Young-growth	Young Young-growth	Unproductive Forest	Non-forested	POG and Mature Young-growth	Young Young-growth	Unproductive Forest	Non-forested	POG and Mature Young-growth	Young Young-growth	Unproductive Forest	Non-forested
5720	76	42	34	10	13	42	34	10	13	42	34	10	13	42	34	10	13	42	34	10	13
5740	70	56	14	12	18	56	14	12	18	56	14	12	18	56	14	12	18	56	14	12	18
5750	69	66	3	17	14	66	3	17	14	66	3	17	14	66	3	17	14	66	3	17	14
5760	55	51	4	27	19	50	4	27	19	50	4	27	19	51	4	27	19	50	4	27	19
5780	76	56	19	9	16	52	21	10	17	52	21	10	17	53	21	10	17	53	21	10	17
5790	77	28	50	12	10	25	52	13	10	25	51	13	11	25	51	13	11	25	51	13	11
5800	77	50	28	11	12	48	29	11	12	46	30	11	13	48	29	11	12	48	29	11	12
5810	79	34	45	10	11	32	46	10	12	32	46	10	12	33	45	10	12	33	45	10	12
5820	77	77	2	13	9	77	2	13	9	75	2	14	9	77	2	13	9	76	2	13	9
5830	77	56	23	10	11	54	24	11	11	53	23	11	12	54	23	11	12	53	24	11	12
5840	79	45	35	13	7	42	37	14	7	43	35	15	8	43	35	14	7	43	36	14	7
5850	73	29	44	17	10	26	46	18	10	26	46	18	10	27	46	18	10	26	46	18	10
5860	86	38	49	6	7	36	50	6	7	36	50	6	8	37	49	6	8	37	49	6	8
5950	63	35	28	22	15	32	29	23	15	32	29	24	16	33	29	23	15	33	29	23	15
5960	46	44	2	33	21	44	2	33	21	44	2	33	21	44	2	33	21	44	2	33	21
5971	56	47	9	24	20	46	9	24	20	46	9	24	20	47	9	24	20	46	9	24	20
5972	63	39	25	22	14	37	26	23	15	37	24	23	15	37	25	23	15	37	25	23	15
5980	66	44	22	23	10	44	22	23	10	44	22	23	10	44	22	23	10	44	22	23	10
Project Area	70	46	25	16	13	44	26	17	14	44	25	17	14	44	25	17	14	44	25	17	14

1/ Landbase includes areas below tree line, defined as all areas below 1,500 ft elevation

2/ Totals may not add up due to rounding.

3/ Mature young-growth includes natural and harvested young-growth stands 50 years old or older. This is the minimum age at which suitable structure for nesting goshawks may be achieved (McClaren 2003).

Alternative 3

Direct and Indirect Effects

Alternative 3 would harvest the most total POG (6,906 acres) and high-volume POG (3,859 acres) among the alternatives, and thus would result in the greatest reduction in potential goshawk habitat (Tables WLD-13 and WLD-14). Approximately 31 percent of harvest would be uneven-aged, thus most units would retain little value to goshawks following harvest (Table WLD-23). Refer to the Biodiversity analysis for a discussion of effects to POG within the biogeographic province and by VCU. Of the seven VCUs which currently maintain at least 50 percent cover of POG and mature young-growth forest, six would continue to do so under Alternative 3 (Table WLD-36). The proportion of VCU 5800 consisting of POG and mature young-growth forest would decline from 50 to 46 percent, potentially resulting in a minor reduction in the suitability of this landscape for goshawk foraging and nesting. Under Alternative 3, the project area as a whole would continue to provide marginal goshawk foraging and nesting habitat, with 44 percent of the landbase in POG and mature young-growth forest (Table WLD-36).

Small OGR modification proposed under Alternative 3 would increase the amount of goshawk habitat (total POG) included in small OGRs in VCUs 5790, 5800 , 5820, 5830, and 5950; modifications in VCUs 5810, 5840, 5850, 5860, and 5972 would decrease the amount of POG included (Table OGR-2). Alternative 3 would decrease the amount of the highest quality goshawk habitat (high-volume POG) included in small OGRs in all VCUs except VCU 5800.

Cumulative Effects

Alternative 3 in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of total POG to 34 to 96 percent of the original levels and the amount of high-volume POG to 15 to 94 percent of the original levels within the project area VCUs (Table WLD-16). Refer to the Biodiversity section for an analysis of cumulative effects to POG within the North Central Prince of Wales biogeographic province and by VCU under Alternative 3. Alternative 3 in combination with past, ongoing, and foreseeable projects would maintain six VCUs with at least 50 percent cover of POG and mature young-growth forest, one less than under Alternative 1 (Table WLD-37).

Small OGR modifications under Alternative 3 would result in a net loss of 843 acres of POG, including 541 acres of high-volume POG included in the Old-growth LUD (Table OGR-2). This would reduce inclusion of goshawk nesting and foraging habitat in the reserve system, making it available for timber harvest which would contribute to the effects of ongoing and foreseeable timber harvest projects on goshawk habitat. Thus, Alternative 3 would increase the likelihood that goshawk habitat quality would decline (if it is harvested), and that locally goshawk habitat would be further fragmented.

Thus, Alternative 3 has the potential to result in a local reduction goshawk nesting and foraging habitat, and in the goshawk prey base. This could result in a reduction in the density of goshawks in the project area VCUs.

Alternative 4

Direct and Indirect Effects

Alternative 4 would harvest 4,627 acres of total POG and 2,612 acres of high-volume POG, the least among the action alternatives (Tables WLD-13 and WLD-14). Thus it would result in the least reduction in goshawk habitat. Refer to the Biodiversity analysis above for a discussion of effects to POG within the biogeographic province and by VCU. Approximately 79 percent of the harvest under Alternative 4 would be uneven-aged or two-aged management, the most among the alternatives (Table WLD-23). This would retain some structural components in harvested stands suitable for goshawks. Of the seven VCUs which currently maintain at least 50 percent cover of POG and mature young-growth forest, six would continue to do so under Alternative 4 (Table WLD-36). The proportion of VCU 5800 consisting of POG and mature young-growth forest would decline from 50 to 48 percent, potentially resulting in a minor reduction in the suitability of this landscape for goshawk foraging and nesting. Under Alternative 4, the project area as a whole would continue to provide marginal goshawk foraging and nesting habitat, maintaining 45 percent of the landbase in POG and mature young-growth forest (Table WLD-36).

Small OGR modifications under Alternative 4 in all VCUs would increase the amount goshawk habitat (total POG) maintained within the reserve system (Table OGR-2). Alternative 4 would increase the amount of the highest quality goshawk habitat (high-volume POG) included in small OGRs in all VCUs except VCUs 5820 and 5972.

Cumulative Effects

Alternative 4 in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of total POG to 33 to 100 percent of the original levels and the amount of high-volume POG to 17 to 100 percent of the original levels within the project area VCUs (Table WLD-16). Refer to the Biodiversity section for an analysis of cumulative effects to POG within the North Central Prince of Wales biogeographic province and by VCU under Alternative 4. Alternative 4 in combination with past, ongoing, and foreseeable projects would maintain six VCUs with at least 50 percent cover of POG and mature young-growth forest, one less than under Alternative 1 (Table WLD-37).

Small OGR modifications under Alternative 4 would result in a net gain of 2,029 acres of POG, including 650 acres of high-volume POG in the Old-growth Habitat LUD (Table OGR-2). This element of Alternative 4 would benefit goshawks because the biologically preferred alternatives are intended to include the largest remaining blocks of POG within each VCU and areas identified as potential goshawk nesting habitat. By maintaining more goshawk habitat within the reserve system, Alternative 4 would maintain goshawk habitat quality (by precluding timber harvest) and thus locally reduce the likelihood that goshawk habitat would be further fragmented.

Thus, Alternative 4 has the potential to result in a local reduction goshawk nesting and foraging habitat, and in the goshawk prey base. This could result in a reduction in the density of goshawks in the project area VCUs.

Alternative 5

Direct and Indirect Effects

Alternative 5 would harvest 5,271 acres of total POG and 2,752 acres of high-volume POG, the second highest amount among the alternatives, which would reduce potential goshawk habitat (Tables WLD-13 and WLD-14). Approximately 55 percent of harvest would be uneven-aged under Alternative 5, thus most units would retain little value to goshawks following harvest (Table WLD-23). Refer to the Biodiversity analysis for a discussion of effects to POG within the biogeographic province and by VCU. Of the seven VCUs which currently maintain at least 50 percent cover of POG and mature young-growth forest, six would continue to do so under Alternative 5 (Table WLD-36). The proportion of VCU 5800 consisting of POG and mature young-growth forest would decline from 50 to 48 percent, potentially resulting in a minor reduction in the suitability of this landscape for goshawk foraging and nesting. Under Alternative 5, the project area as a whole would continue to provide marginal goshawk foraging and nesting habitat, maintaining 45 percent of the landbase in POG and mature young-growth forest (Table WLD-36).

No small OGR modifications would occur under Alternative 5; therefore, there would be no related effects to the goshawk.

Cumulative Effects

Alternative 5 in combination with past, ongoing, and foreseeable projects would collectively reduce the amount of total POG to 33 to 97 percent of the original levels and the amount of high-volume POG to 15 to 95 percent of the original levels within the project area VCUs (Table WLD-16). Refer to the Biodiversity section for an analysis of cumulative effects to POG within the North Central Prince of Wales biogeographic province and by VCU under Alternative 5. Alternative 5 in combination with past, ongoing, and foreseeable projects would maintain six VCUs with at least 50 percent cover of POG and mature young-growth forest, one less than under Alternative 1 (Table WLD-37). Thus, Alternative 5 has the potential to result in a local reduction goshawk nesting and foraging habitat, and in the goshawk prey base. This could result in a reduction in the density of goshawks in the project area VCUs.

Conclusion

Habitat suitability in most project area VCUs is marginal based on the proportion of the landbase consisting of POG and mature young growth. These conditions would be maintained in all VCUs under all action alternatives except VCU 5800 where the proportion of these forested vegetation types would drop from 50 percent to 46 to 48 percent depending on alternative. At the scale of the biogeographic province the action alternatives would result in a minor reduction in suitable nesting and foraging habitat for goshawks through the removal for forest cover. Under all alternatives there would be no direct impacts to any known nest area. Effects to goshawks would be greatest under Alternative 3, followed by Alternatives 2, 5, 4, and 1. Reductions in forested vegetation at a VCU level would reduce the local suitability of foraging and nesting habitat for goshawks. Reductions in nesting and foraging habitat in the North Central Prince of Wales Island biogeographic province could result in the local expansion of individual goshawk home ranges, potentially leading to a reduction in breeding density. However, given that goshawks are highly mobile and that breeding density is currently low within the North Central Prince of Wales Island biogeographic province, and habitat is protected under the Forest Plan conservation strategy, the effects of the Big Thorne Project in combination with past, present, and foreseeable activities may adversely impact individuals, but are not likely to result in a loss of viability in the Planning Area, nor cause a trend toward Federal listing. Forest Plan conservation strategy maintains habitat for goshawks.

Subsistence

Direct and Indirect Effects – All Alternatives

ANILCA requires that any analysis of project-related effects on Federal lands within Alaska take into account, 1) subsistence resource distribution and abundance, 2) access to these resources by subsistence users, and 3) competition for the use of these subsistence resources. This is because changes in access to subsistence resources due to project-related activities can affect the level of effort required, time involved, and the effectiveness of harvesting these resources. Altered distributions and abundance of subsistence resources can effect competition between subsistence and non-subsistence user, as well as competition between individual subsistence users.

Road building associated with timber harvesting is an important agent of change in Southeast Alaska. These road networks provide greater access to areas previously not accessible and can affect subsistence both positively and negatively by providing access, dispersing hunting and fishing pressure, and creating the potential for increased competition for favored hunting areas among communities connected by the existing road system (USDA Forest Service 2008b).

None of the Big Thorne Project alternatives would present “a significant possibility of a significant restriction” of subsistence uses for most subsistence resources (fish and marine invertebrates, food plants, personal use timber, upland game birds and waterfowl, furbearers, and marine mammals). These resources are briefly discussed below.

The direct and indirect effects of the Big Thorne Project alternatives may have a significant possibility of a significant restriction for subsistence uses of deer in the project area WAAs (USDA Forest Service 2008c). As noted above, deer are considered the “indicator” for potential subsistence resource consequences concerning the abundance and distribution of the resources, given their association with old-growth forest habitat and that they are the largest terrestrial component of subsistence food resources (USDA Forest Service 2008b); therefore, they are the only species addressed in detail in this analysis.

Sitka Black-tailed Deer

Abundance and Distribution

The abundance and distribution of deer is generally based on assessing the number and location of deer available for hunter harvest. After timber harvest, deer may shift their patterns of activity in response to forest succession, and the density of deer may decline as even-aged young-growth stands progress beyond shrub and sapling stages to stem-exclusion forests (Wallmo and Schoen 1980). As described in the Deer Effects section, implementation of the action alternatives would locally reduce deer winter habitat capability; which, over the long-term, could result in a reduction in deer numbers.

Alternatives that result in the greatest reduction in deer habitat capability would be expected to have the greatest effect to deer abundance and distribution.

Access

Road building associated with timber harvesting is an important agent of change in Southeast Alaska. These road networks provide greater access to areas previously not accessible and can affect subsistence both positively and negatively by providing access, dispersing hunting pressure, and creating the potential for increased competition for favored hunting areas among communities connected by the existing road system (USDA Forest Service 2008b). New proposed roads would be closed and stored 1 to 5 years after timber harvest activities are completed, under all alternatives; during the 1 to 5 year period, they would be open seasonally (from May 1 to November 30) to High Clearance Vehicles to allow for firewood removal and other incidental uses and would improve access (see the Transportation section for more information on road management objectives).

Alternatives that would result in the greatest increase in the road system would be expected to result in the greatest increase in access to both subsistence and non-subsistence hunters. The greatest increase in road access would occur during project implementation when temporary and new roads are in use. Road access would decrease as road closures are applied, making them no longer available for use by motorized vehicles. Historical access would remain available under all the alternatives. Under all action alternatives there would be temporary restrictions in road access to subsistence during active logging operations as a safety precaution. As this project would occur over 10-years, all proposed timber operations, and temporary road closures would not occur simultaneously.

Timber harvest would also increase access to deer over the short term, due to the clearing of dense vegetation which makes them more visible to hunters. In a study of the influence of industrial logging on deer harvest on Prince of Wales Island, Brinkman et al. (2009) determined that hunters preferred habitats with open terrain, low vegetative cover, and high visibility (i.e., clearcuts). However, shrub and trees establishment in harvested areas associated with the transition of the forest to the stem exclusion stage creates undesirable hunting conditions (i.e., low visibility). Young-growth stands were least popular for hunting because they impeded the hunters' ability to see deer and were thought to contain fewer deer (Brinkman et al. 2009). Young-growth management, proposed under Alternatives 3, 4, and 5, may locally improve hunter access to deer over the long term.

Competition

Competition for subsistence resources is a result the distribution and fluctuation in population levels of game species, harvest regulations, mobility, and access provided to rural communities in the form of roads, ferries, and commercial air carriers. The Big Thorne project area is commonly used by subsistence hunters from a number of local communities for harvesting deer and other subsistence resources. The road network on Prince of Wales Island connects most of the communities on the island to the project area, and has allowed communities access to the area for hunting and other subsistence activities. Non-subsistence users (e.g., those from Ketchikan and Juneau, as well as out-of-state hunters) also hunt in the project area.

Timber harvest can influence competition for resources through new road construction, particularly near communities potentially generating competition from outside communities with lower abundance of the same resources. Habitat alternations that reduce carrying capacity, which could in turn reduce deer densities, will also increase competition for deer if allowable levels of harvest remain the same but available subsistence resources are diminished. Indirectly, displacement of subsistence hunters from areas with active timber harvest operations could temporarily increase competition in other subsistence use areas. Alternatives resulting in the greatest reduction in deer carrying capacity and increase in the road system would be expected to result in the greatest likelihood of increasing competition for resources.

Other Subsistence Resources

Fish and Marine Invertebrates

The Big Thorne Project would not affect the abundance and distribution of or competition for anadromous or marine fish and marine invertebrates. The risk of project-related impacts to fish populations due to timber harvest would be minimal because of Tongass Timber Reform Act (TTRA) stream buffers, and Forest Plan beach and estuary, riparian, and fish standards and guidelines which maintain water quality and fish habitat (See Issue 4 for detailed assessment). Although the project may adversely affect Freshwater Essential Fish Habitat (EFH) and Marine EFH, effects would be temporary and localized. Fishing and marine invertebrate harvesting occurs primarily from boats, on beaches, and along estuaries. No activity associated with the Big Thorne Project is expected to occur in the marine environment that would preclude access to these resources. Freshwater fisheries are accessed by the road system, with motorized vehicles and OHVs. New roads under Alternatives 2, 3, 4, and 5, some of which would remain open for a period of years, may temporarily increase access to streams used for subsistence fishing. Some existing roads would be closed to public use for safety reasons during active timber harvesting, but any reduction in access would be temporary and localized.

Food Plants and Personal Use Timber

None of the alternatives are expected to negatively affect the abundance or distribution of subsistence plants gathered for food, because these resources are abundant along roads and in previously harvested areas. They are also are expected to increase in harvested stands during the early successional stage, declining thereafter. The Big Thorne Project would also not preclude Alaska residents from obtaining timber and firewood for personal use. New roads under Alternatives 2, 3, 4, and 5, some of which would remain open for a period of years, may temporarily increase access to areas where food plants and firewood can be gathered. Some existing roads would be closed to public use for safety reasons during active timber harvesting, but any reduction in access would be temporary and localized. Given that any beneficial changes in the abundance and distribution of food plants, and temporary effects to access, would be distributed throughout the project area over time (i.e., over the 10-year project period and beyond), no changes in competition for food plants or personal use timber would be expected.

Upland Game Birds and Waterfowl

All action alternatives would reduce upland game bird habitat (e.g., POG) and have the potential to increase vulnerability to harvest associated with increased access (see discussion of spruce grouse above). The presence of OGRs in the Big Thorne project area and implementation of standards and guidelines that maintain connectivity within matrix lands (e.g., various buffer requirements) would help sustain local populations. No measurable effects to waterfowl would occur, given that most species occur in the project area only during migration on lakes and in bays and estuaries (an exception is the Vancouver Canada goose which uses forested and non-forested wetlands), and thus would be minimally exposed to project-related activities in the vicinity of these areas. Thus no changes in the abundance or distribution of upland game birds and waterfowl are anticipated under any of the alternatives. The number of hunters may temporarily increase in the project area due to increased access along project roads, but competition would likely remain the same because upland birds and waterfowl do not contribute a large percentage of the foods for the subsistence communities in the project area.

Furbearers

Estuary, riparian, and forested coastal habitats that receive the greatest use by furbearers such as river otters, beavers, and ermine are protected under Forest Plan conservation strategy. Therefore, the Big Thorne Project would not affect the abundance or distribution of these species.

Timber harvest (through the removal of POG and associated fragmentation) and road building (increased access) could affect the local distribution of marten (see Marten discussion above). Marten may become more vulnerable to harvest due to increased trapper access along project roads. This could increase competition among local communities, particularly if increased access in currently accessible areas were to lead to overharvest. However, these effects would be somewhat mitigated through project road closure and closures under the Prince of Wales Island ATM.

Marine Mammals

Marine mammals have the potential to be exposed to disturbance and noise associated with marine access facilities (MAFs) activity, potential collisions with vessels, and fuel or oil spills associated with vessel traffic. Alternatives 2, 3, 4, and 5 have the potential to result in a minor increase in vessel activity at the existing MAFs and in association with the export of logs. However, vessel activity would be infrequent, and would be spread over 10 years. Vessels used to transport logs are not likely to affect the abundance or distribution of marine mammals in Clarence Strait, given the transient nature of these species and the fact that such vessels typically operate at low, constants speeds, giving the marine mammal species time for avoidance, and would operate at infrequent intervals. Additionally, it is assumed that all vessels operating on behalf of the Big Thorne Project would adhere to Marine Mammal Protection Act, Endangered Species Act (ESA), and National Marine Fisheries Service (NMFS) guidelines for approaching marine mammals, as required under the Forest Plan. Therefore, no change in access to, or competition for, marine mammals would occur as a result of the project.

Cumulative Effects – All Alternatives

Sitka Black-tailed Deer

Abundance and Distribution

Past timber harvest has altered the distribution of deer used by the communities in the vicinity of the Big Thorne Project, through changes in the distribution of habitat types and road development. Ongoing and foreseeable timber harvests and associated road construction, as well as other development, would contribute to these effects. The Big Thorne Project, in conjunction with past and foreseeable actions, may further alter the abundance or distribution of deer through reductions in carrying capacity.

It is assumed that a deer population at carrying capacity should be able to support a sustainable hunter harvest (demand) equal to approximately 10 percent of the habitat capability while also providing a reasonably high level of hunter success in the WAA (USDA Forest Service 2008b). Hunter success can be expected to decline (through reduced hunter efficiency and moderate difficulty in obtaining deer) in areas where demand equates to between 10 and 20 percent of habitat capability. If demand exceeds 20 percent of habitat capability, harvest of deer by hunters may be directly (through restriction in seasons and bag limits) or indirectly (through reduced hunter efficiency and increased difficulty in obtaining deer relative to historical rates) affected (USDA Forest Service 2008b). A comparison of projected numbers of deer available, based on modeled deer habitat capability (taking all landownerships into account), and hunter demand by WAA is provided in Table WLD-38. Because actual hunter demand is unknown, hunter harvest data (number of deer taken) from 2005 to 2010 were used to represent hunter demand. It should be noted that this likely underestimates actual hunter demand, as it does not include hunters who were not successful in taking any deer or took fewer deer than they desired.

Habitat capability in WAA 1319 currently appears adequate to sustain current levels of deer harvest (i.e., hunter demand is less than 10 percent of habitat capability; Table WLD-38). Current levels of deer harvest would be expected to decline in WAAs 1315 and 1318 (i.e., hunter demand is between 10 and 20 percent of habitat capability; Table WLD-38). Due to past timber harvest, existing deer habitat capability in WAA 1420 may not be adequate to sustain the current levels of deer harvest (i.e., hunter demand is over 20 percent of habitat capability; Table WLD-38). Over time, hunter success in WAA 1420 would be expected to decline due to reduced hunter efficiency and moderate difficulty in obtaining deer (USDA Forest Service 2008b).

Commercial thinning proposed under Alternatives 3, 4, and 5 would improve deer habitat by extending the period during which forage is available. Over time, these actions would increase deer habitat capability, and therefore potentially the abundance and distribution of deer available to hunters. Improvements in deer habitat capability may also reduce necessity for hunting restrictions.

Table WLD-38. Hunter Demand by WAA of Current (2013) and Projected Deer Habitat Capability by Alternative (NFS and non-NFS[1/] lands) Incorporating Past and Foreseeable Projects

		Wildlife Analysis Area (WAA)			
		1315	**1318**	**1319**	**1420**
WAA Area (square miles)		152.6	199.2	163.3	73.5
Hunter Demand (no. deer)[2/]		280	138	203	182
Existing Deer Habitat Capability (deer/sq. mi.)[3/]		9.4	6.1	15.8	10.5
Total Deer Habitat Capability (per WAA)					
Current Conditions		1,418	1,175	2,540	754
Alternative 1	Project Completion	1,415	1,170	2,526	753
	Stem Exclusion	1,320	1,122	2,426	664
Alternative 2	Project Completion	1,357	1,131	2,416	724
	Stem Exclusion	1,264	1,083	2,317	635
Alternative 3	Project Completion	1,319	1,116	2,381	689
	Stem Exclusion	1,225	1,068	2,284	602
Alternative 4	Project Completion	1,362	1,136	2,419	722
	Stem Exclusion	1,269	1,088	2,322	634
Alternative 5	Project Completion	1,347	1,130	2,413	714
	Stem Exclusion	1,254	1,082	2,316	626
Hunter Demand as % of Habitat Capability [4/]					
Current Conditions		19.7%	11.7%	8.0%	24.1%
Alternative 1	Project Completion	19.8%	11.8%	8.0%	24.2%
	Stem Exclusion	21.2%	12.3%	8.4%	27.4%
Alternative 2	Project Completion	20.6%	12.2%	8.4%	25.1%
	Stem Exclusion	22.2%	12.7%	8.8%	28.7%
Alternative 3	Project Completion	21.2%	12.4%	8.5%	26.4%
	Stem Exclusion	22.9%	12.9%	8.9%	30.2%
Alternative 4	Project Completion	20.6%	12.1%	8.4%	25.2%
	Stem Exclusion	22.1%	12.7%	8.7%	28.7%
Alternative 5	Project Completion	20.8%	12.2%	8.4%	25.5%
	Stem Exclusion	22.3%	12.8%	8.8%	29.1%

1/ Assumes deer habitat capability is zero on all non-NFS acres.
2/ Hunter harvest data (including resident and nonresident hunters) from 2005 to 2010 was used to estimate the average hunter harvest, representing hunter demand.
3/ Deer habitat capability calculated from the deer model for winter habitat at all elevations. Habitat Suitability Indices (HSIs) were standardized to range from 0.0 to 1.0; 100 deer per square mile used as multiplier; all harvest units were assumed to be even-aged; no predation was included.
4/ Assumes average annual deer harvest between 2005 and 2009 (resident and non-resident) represents demand; ≤10 = reasonably high hunter success expected, 10-20 = Hunter success can be expected to decline, >20 = harvest may be directly (through restriction in seasons and bag limits) or indirectly (through reduced hunter efficiency and increased difficulty in obtaining deer relative to historical rates) affected (USDA Forest Service 2008b).
Source: GIS Database, deer_model.aml

Access/ Competition

Collectively, new proposed roads associated with the Big Thorne Project in addition to those resulting from other projects would temporarily improve access and reduce competition. All alternatives would implement the Prince of Wales Island ATM, under which additional road closures would occur as funding allows, reducing access to subsistence resources over the long term (USDA Forest Service 2009a).

Alternative 1

Direct and Indirect Effects

Alternative 1 would have no direct effects on deer as no project-related activities would occur. Abundance and distribution of, access to, and competition for deer under Alternative 1 would be similar to existing conditions.

Under Alternative 1 there would be no change in OGR boundaries. As a result, access for deer in these areas would be unchanged. Further, the current amount of deer winter habitat incorporated in project area small OGRs would be maintained under these alternatives. Thus, there would be no change in the availability of deer to subsistence hunters.

Abundance and Distribution

However, there would be indirect effects to deer habitat over time in the absence of young-growth management as existing previously harvested stands move into the stem exclusion stage thereby reducing the abundance of the resource (deer; Table WLD-19). Conditions in unmanaged young-growth stands reduce access to deer and increased undesirable habitat for deer hunting (Brinkman et al. 2009). Thus, over time, reductions in habitat capability for deer may reduce the deer abundance. Under Alternative 1, deer habitat capability would be reduced by less than 1 percent at project completion, and by 4 to 11 percent at stem exclusion, depending on the WAA (Table WLD-19).

Access

Under Alternative 1, no new roads would be constructed. Therefore, road access would remain the same.

Competition

Reductions in deer habitat capability at stem exclusion primarily result from the progression of recently harvested stands on non-NFS lands to the stem exclusion phase. As hunter efficiency and success decrease in these areas, there is the potential for increased competition for deer on NFS lands where habitat capability, and potentially deer abundance, is higher.

Cumulative Effects

Abundance and Distribution

Alternative 1 would have negligible impacts to subsistence because it would not result in a measureable reduction in deer habitat capability or result in road building (Table WLD-38). However, Alternative 1 would benefit from the improvement in deer habitat quality resulting from young-growth treatments and watershed restoration projects that involve thinning on NSF lands. Therefore, under Alternative 1, the distribution of and competition for subsistence resources would remain as they are; however, the abundance of deer may change as stands move into the stem exclusion stage.

Alternative 1 in combination with past, ongoing, and foreseeable projects would maintain 54 to 92 of the original (1954) deer habitat capability at project completion, and 48 to 88 of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-21). Alternative 1 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 31 to 65 percent of original amounts; average snow winter habitat to 44 to 75 percent of original amounts; and non-winter habitat to 67 to 86 percent) of original amounts depending on the WAA (Table WLD-22).

Access

Under Alternative 1, road closures under the Prince of Wales Island ATM would be implemented. This would reduce access to subsistence resources. With ATM implementation, there would be a total of 44 miles of motorized trails under Alternative 1 (see Table TRAN-6 in the Transportation section).

Competition

Reductions in deer habitat capability at stem exclusion primarily result from the progression of recently harvested stands on non-NFS lands to the stem exclusion phase. As hunter efficiency and success decrease in these areas, there is the potential for increased competition for deer on NFS lands where habitat capability, and potentially deer abundance, is higher.

Alternative 2

Direct and Indirect Effects

Abundance and Distribution

Effects to deer habitat capability by WAA under Alternative 2 are described under the Sitka Black-tailed Deer subsection (Table WLD-19). Alternative 2 would result in an immediate reduction in deer habitat capability by WAA ranging from 4 to 5 percent from current conditions, the second highest among the alternatives (Table WLD-19). At stem exclusion, deer habitat capability would be reduced by a total of 8 to 16 percent from current conditions, depending on the WAA (Table WLD-19). Alternative 2 would result in the harvest of approximately 1,537 acres of deep snow winter habitat (3 to 7 percent reduction from current conditions by WAA), 4,787 acres of average snow winter habitat (3 to 6 percent reduction from current conditions by WAA), and 5,119 acres of non-winter habitat (1 to 3 percent reduction from current conditions by WAA; Table WLD-20).

Access

Alternative 2 would result in an increase in approximately 50 miles of open roads, of which approximately 26 would be new or reconstructed NFS roads that would be open seasonally from 1 to 5 years following harvest to allow for firewood removal and other incidental uses and 24 miles would be temporary roads (see Table TRAN-3 in Transportation section). Most would be in WAA 1319 (23 miles), followed by WAAs 1315 (15 miles), 1420 (8 miles), and 1318 (5 miles). Approximately 2 miles of road would be converted to motorized trails when the roads are stored. Of the four action alternatives, this alternative proposes the second highest amount of new road construction, and would have the second greatest temporary improvement in access.

Competition

Under Alternative 2, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at project completion (Table WLD-38).

OGRs

No OGR modifications are proposed under Alternative 2; therefore the OGRs would provide deer as a subsistence resource with abundance (deer habitat capability in the OGRs), access (miles of road in the OGRs), distribution (winter habitat in the OGRs), and competition the same as under Alternative 1.

Cumulative Effects

Abundance and Distribution

Under Alternative 2, the Big Thorne Project in combination with past, ongoing, and reasonably foreseeable projects would maintain 52 to 89 percent of the original (1954) deer habitat capability at project completion, and 46 to 85 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-21). Alternative 2 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 30 to 61 percent of original amounts; average snow winter habitat to 43 to 71 percent of original amounts; and non-winter habitat to 66 to 84 percent of original amounts, depending on the WAA (Table WLD-22).

Commercial thinning would not occur under Alternative 2, and therefore it would not contribute to the improvement of deer habitat resulting from young-growth treatments and other projects that involve thinning on NFS lands.

Access

Cumulative open road miles by WAA under Alternative 2, accounting for all landownerships and all elevations, would be highest in WAA 1318 (357 miles), followed by WAAs 1315 (287 miles), 1319 (107 miles), and 1420 (81 miles), the second highest among the alternatives. This includes road construction from other timber harvest projects, which would also increase access. With ATM implementation, there would be a total of 47 miles of motorized trails under Alternative 2 (see Table TRAN-6 in the Transportation section). Road closures under the Prince of Wales Island ATM implemented under Alternative 2 would ultimately reduce access to, and may increase competition for, deer in the project area due to the reduction in motorized road access (USDA Forest Service 2009a).

Competition

Under Alternative 2, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at stem exclusion (Table WLD-38).

Alternative 3

Direct and Indirect Effects

Abundance and Distribution

Effects to deer habitat capability by WAA under Alternative 3 are described under the Sitka Black-tailed Deer subsection (Table WLD-19). Alternative 3 would result in an immediate reduction in deer habitat capability by WAA ranging from 5 to 9 percent from current conditions, the most among the alternatives (Table WLD-19). At stem exclusion, deer habitat capability would be reduced by a total of 9 to 20 percent from current conditions, depending on the WAA (Table WLD-19).

Alternative 3 would result in the harvest of approximately 2,358 acres of deep snow winter habitat (6 to 13 percent reduction from current conditions by WAA), 6,706 acres of average snow winter habitat (3 to 9 percent reduction from current conditions by WAA), and 7,113 acres of non-winter habitat (1 to 5 percent reduction from current conditions by WAA (Table WLD-20).

Access

Alternative 3 would result in an increase in approximately 89 miles of open roads, of which approximately 51 would be new or reconstructed NFS roads that would be open seasonally from 1 to 5 years following harvest to allow for firewood removal and other incidental uses and 38 miles would be temporary roads (see Table TRAN-3 in Transportation Section). Most would be in WAA 1319 (38 miles), followed by WAAs 1315 (28 miles), 1420 (17 miles), and 1318 (7 miles). Approximately 3 miles of road would be converted to motorized trails when the roads are stored. Of the four action alternatives, this alternative proposes the highest amount of new road construction, and thus would result in the greatest temporary improvement in access.

Competition

Under Alternative 3, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at project completion (Table WLD-38).

OGRs

With the exception of VCU 5820 (Baird Peak), small OGR modifications under Alternative 3 would reduce inclusion of deep snow deer winter range in the reserve system. Harvest of these areas would reduce the amount of suitable habitat for deer (Table OGR-2), which could reduce the abundance and distribution of deer in the project area.

Cumulative Effects

Abundance and Distribution

Under Alternative 3, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 49 to 88 percent of the original (1954) deer habitat capability at project completion, and 43 to 84 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-21). The level of deer habitat capability maintained under Alternative 3 would be the least among the alternatives. Under Alternative 3, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at project completion and at stem exclusion (Table WLD-38).

Alternative 3 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 27 to 60 percent of original amounts; average snow winter habitat to 42 to 70 percent of original amounts; and non-winter habitat to 65 to 83 percent of original amounts, depending on the WAA (Table WLD-22).

Commercial thinning under Alternative 3 would contribute to the improvement of deer habitat resulting from young-growth treatments and other projects that involve thinning on NFS lands. Over time, these actions would increase deer habitat capability, and therefore potentially the abundance and distribution of deer available to hunters. Improvements in deer habitat capability would also reduce necessity for hunting restrictions.

Access

Cumulative open miles by WAA under Alternative 3, accounting for all landownerships and all elevations, would be highest in WAA 1318 (357 miles), followed by WAAs 1315 (291 miles), 1319 (107 miles), and 1420 (82 miles), the highest among the alternatives. This includes road construction from other timber harvest projects, which would also increase access. With ATM implementation, there would be a total of 47 miles of motorized trails under Alternative 3 (see Table TRAN-6 in the Transportation section). Road closures under the Prince of Wales Island ATM implemented under Alternative 3 would ultimately reduce access to, and may increase competition for, deer in the project area due to the reduction in motorized road access (USDA Forest Service 2009a).

Competition

Under Alternative 3, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at stem exclusion (Table WLD-38).

Alternative 4

Direct and Indirect Effects

Abundance and Distribution

Effects to deer habitat capability by WAA under Alternative 4 are described under the Sitka Black-tailed Deer subsection (Table WLD-19). Alternative 4 would result in an immediate reduction in deer habitat capability by WAA ranging from 3 to 5 percent from current conditions, the least among the action alternatives (Table WLD-19). At stem exclusion state, deer habitat capability would be reduced by a total of 7 to 15 percent from current conditions, depending on the WAA (Table WLD-19).

Alternative 4 would result in the harvest of approximately 1,319 acres of deep snow winter habitat (2 to 6 percent reduction from current conditions by WAA), 4,421 acres of average snow winter habitat (2 to 5 percent reduction from current conditions by WAA), and 4,772 acres of non-winter habitat (1 to 3 percent reduction from current condition by WAA) (Table WLD-20).

Access

Alternative 4 would result in an increase in approximately 32 miles of open roads, of which approximately 20 would be new or reconstructed NFS roads that would be open seasonally from 1 to 5 years following harvest to allow for firewood removal and other incidental uses and 11 miles would be temporary roads (see Table TRAN-3 in Transportation Section). Most would be in WAA 1319 (12 miles), followed by WAAs 1315 (10 miles), 1420 (7 miles), and 1318 (2 miles). Under Alternative 4, less than 0.5 mile of roads would be converted to motorized trails when the roads are stored. Of the four action alternatives, this alternative proposes the least amount of new road construction, and thus would have the least effects related to temporarily improving access.

Competition

Under Alternative 4, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at project completion (Table WLD-38).

OGRs

In most VCUs (all except the small OGR in VCU 5830) small OGR modifications proposed under Alternative 4 would increase inclusion of deep snow winter habitat and low-elevation POG in small OGRs (Table OGR-2). This could increase the abundance and distribution of deer in the project area, through protection of these stands.

Cumulative Effects

Abundance and Distribution

Under Alternative 4, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 52 to 89 percent of the original (1954) deer habitat capability at project completion, and 45 to 86 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-21). Under Alternative 4, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at project completion and stem exclusion (Tables WLD-38). Alternative 4 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 31 to 61 percent of original amounts; average snow winter habitat to 43 to 71 percent of original amounts; and non-winter habitat to 66 to 84 percent of original amounts, depending on the WAA (Table WLD-22).

Commercial thinning under Alternative 4 would contribute to the improvement of deer habitat resulting from young-growth treatments and other projects that involve thinning on NFS lands.

Access

Cumulative open miles by WAA under Alternative 4, accounting for all landownerships and all elevations, would be highest in WAA 1318 (356 miles), followed by WAAs 1315 (285 miles), 1319 (103 miles), and 1420 (80 miles), the least among the action alternatives (and comparable to Alternative 5). This includes road construction from other timber harvest projects, which would also increase access. With ATM implementation, there would be a total of 44 miles of motorized trails under Alternative 4 (see Table TRAN-6 in the Transportation section). Road closures under the Prince of Wales Island ATM implemented under Alternative 4 would ultimately reduce access to, and may increase competition for, deer in the project area due to the reduction in motorized road access (USDA Forest Service 2009a).

Competition

Under Alternative 4, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at stem exclusion (Table WLD-38).

Alternative 5

Direct and Indirect Effects

Abundance and Distribution

Effects to deer habitat capability by WAA under Alternative 5 are described under the Sitka Black-tailed Deer subsection (Table WLD-19). Alternative 5 would result in an immediate reduction in deer habitat capability by WAA ranging from 4 to 5 percent from current conditions (Table WLD-19). At stem exclusion, deer habitat capability would be reduced by a total of 8 to 16 percent from current conditions, depending on the WAA (Table WLD-19). Effects would be less than under Alternative 2 and 3, but greater than under Alternative 4.

Alternative 5 would result in the harvest of approximately 1,613 acres of deep snow winter habitat (3 to 7 percent reduction from current conditions by WAA), 5,085 acres of average snow winter habitat (3 to 6 percent reduction from current conditions by WAA), and 5,465 acres of non-winter habitat (1 to 3 percent reduction from current conditions by WAA (Table WLD-20).

Access

Alternative 5 would result in an increase in approximately 31 miles of open roads, of which approximately 17 would be new or reconstructed NFS roads that would be open seasonally from 1 to 5 years following harvest to allow for firewood removal and other incidental uses and 15 miles would be temporary roads (see Table TRAN-3 in Transportation Section). Most would be in WAAs 1319 (18 miles each), followed by WAAs 1420 (8 miles), 1315 (3 miles), and 1318 (2 miles). Less than 0.5 mile of road would be converted to motorized trails when the roads are stored. Of the four action alternatives, this alternative proposes the second least amount of new road construction, and thus would have the second lowest effects related to temporarily improving access.

Competition

Under Alternative 5, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at project completion (Table WLD-38).

OGRs

No OGR modifications are proposed under Alternative 5; therefore, the OGRs would provide deer as a subsistence resource with abundance (deer habitat capability in the OGRs), access (miles of road in the OGRs), distribution (winter habitat in the OGRs), and competition the same as under Alternative 1.

Cumulative Effects

Abundance and Distribution

Under Alternative 5, the Big Thorne Project in combination with past, ongoing, and foreseeable projects would maintain 51 to 89 percent of the original (1954) deer habitat capability at project completion, and 45 to 85 percent of the original deer habitat capability at stem exclusion, depending on the WAA (Table WLD-21). Under Alternative 5, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at project completion and stem exclusion (Table WLD-38). Changes in hunter success under Alternative 5 would be comparable to those under Alternatives 2 and 4. Alternative 5 in combination with past, ongoing, and foreseeable projects would also result in a cumulative reduction in deep snow winter habitat to 29 to 61 percent of original amounts; average snow winter habitat to 43 to 71 percent of original amounts; and non-winter habitat to 66 to 84 percent of original amounts, depending on the WAA (Table WLD-22).

Commercial thinning under Alternative 5 would contribute to the improvement of deer habitat resulting from young-growth treatments and other projects that involve thinning on NFS lands.

Access

Cumulative open road miles by WAA under Alternative 5, accounting for all landownerships and all elevations, would be highest in WAA 1318 (356 miles), followed by WAAs 1315 (285 miles), 1319 (104 miles), and 1420 (50 miles), the second least among the action alternatives (and comparable to Alternative 4). This includes road construction from other timber harvest projects, which would also increase access. With ATM implementation, there would be a total of 45 miles of motorized trails under Alternative 5 (see Table TRAN-6 in the Transportation section). Road closures under the Prince of Wales Island ATM implemented under Alternative 5 would ultimately reduce access to, and may increase competition for, deer in the project area due to the reduction in motorized road access (USDA Forest Service 2009a).

Competition

Under Alternative 5, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at stem exclusion (Table WLD-38).

Other Subsistence Resources

Fish and Marine Invertebrates/ Food Plants and Personal Use Timber/ Upland Game Birds and Waterfowl/ Furbearers/ Marine Mammals

The Big Thorne Project would have no effect to the abundance or distribution of, access to, or competition for marine fish and invertebrates, waterfowl, furbearers using estuary, riparian, or coastal habitats, or marine mammals. Therefore, the project would make no contribution to cumulative effects to these species. Exceptions are the Vancouver Canada goose (waterfowl), and marten (furbearer) which would be affected by reductions in POG habitat and/or increased road densities and related effects associated with increased human access under all the action alternatives (see the species-specific discussions above). Ongoing and foreseeable timber harvest projects would contribute to these effects. The Big Thorne project would result in temporary increases in the abundance and distribution of food plants, and temporary increases in access to food plants/personal use timber and freshwater fish. Ongoing and foreseeable timber harvest (through increases in early seral forest and roads) would contribute to these effects.

Conclusion

The Record of Decision (ROD) for the 2008 Forest Plan Final EIS (USDA Forest Service 2008b) concluded that the "deer habitat capabilities in areas of the Tongass with heavier timber harvest may not be adequate to sustain current and future deer harvest levels, and that increased competition for deer harvest may cause a significant possibility of a significant restriction in the future." The cumulative effects analysis in the 2008 Forest Plan Final EIS concluded that full implementation of the Forest Plan may result in a significant restriction to subsistence use of deer due to the potential effects of projects on the abundance and distribution of this resource, and on competition for this resource (USDA Forest Service 2008b). A discussion of the Section 810 determination for the Forest Plan is provided in the 2008 ROD.

The ROD for the Big Thorne Project will include a final finding about any significant restrictions on subsistence uses that may result from implementation of the Selected Alternative. The following summarizes the anticipated finding:

- The direct and indirect effects from all alternatives associated with the Big Thorne Project do not present a significant possibility of a significant restriction of subsistence uses of fish and marine invertebrates, food plants, personal use timber, upland game birds and waterfowl, furbearers, marine mammals or deer.
- The potential cumulative effects associated with implementing the Forest Plan through the entire rotation period, which include the Big Thorne Project no action and action alternatives, do not present a significant possibility of a significant restriction to subsistence uses fish and marine invertebrates, food plants, personal use timber, upland game birds and waterfowl; however, a possibility of a restriction may exist for deer.

Under all alternatives, hunter success would be expected to remain high in WAA 1319, decline in WAA 1318, and be directly or indirectly reduced through harvest restrictions or difficulty obtaining deer in WAAs 1315 and 1420 at project completion and stem exclusion (Tables WLD-38).

Subsistence Findings

The 1997 Forest Plan Final EIS (USDA Forest Service 1997a) included a cumulative effects analysis of resource development on subsistence resources. Based on that analysis, the Forest Plan ROD (USDA Forest Service 2008b) concluded that full implementation of the Forest Plan "may result in a significant restriction to subsistence use of deer due to the potential effects of projects on the abundance and distribution of these resources, and on competition for these resources". It is not possible to substantially reduce timber harvest in one area and concentrate it in other areas without affecting subsistence resources and uses important to one or more rural communities (USDA Forest Service 1997a).

For this reason, timber sale activities cannot completely avoid cumulative landscape effects to subsistence uses. Based on this evaluation and ANILCA definitions of significance, it was determined that, in combination with other past, present and reasonably foreseeable future actions, all of the alternatives (if implemented through project-level decisions and actions) may result in a significant restriction of subsistence uses of deer, due to potential effects on abundance and distribution, and on competition. This determination is based on an anticipated increase in human population, an associated increase in subsistence activities, and the capability of the habitat to produce deer. As a result of this finding, the Forest Service will notify the appropriate state agencies, local communities, the Southeast Alaska Federal Subsistence Regional Advisory Council, and State Fish and Game Advisory Committees.

Section 810 (a)(3) of ANILCA requires that when a use, occupancy, or disposition of public lands may result in a significant possibility of a significant restriction, a determination must be made whether (1) such a restriction is necessary, consistent with sound management principles for the utilization of public lands, (2) the proposed activity involves the minimum amount of public lands necessary to accomplish the purposes of the use, and (3) reasonable steps will be taken to minimize adverse impacts on subsistence uses and resources resulting from the actions.

Using the information described earlier in this section, the alternatives were evaluated for potential effects on subsistence uses and needs, as described above.

Necessary and Consistent with Sound Management of Public Lands: The alternatives proposed in this EIS have been examined to determine whether they are necessary and consistent with sound management of public lands. In this regard, the National Forest Management Act, the Alaska National Interest Lands Conservation Act, the Tongass Timber Reform Act, the Wilderness Act, the 2008 Forest Plan Amendment Final EIS, the Alaska State Forest Resources and Practices Act, and the Alaska Coastal Zone Management Program have been considered.

National Forest land management plans are required by the National Forest Management Act and must provide for the multiple-use and sustained yield of renewable forest resources in accordance with the Multiple-Use Sustained Yield Act of 1960. Multiple-use is defined as "the management of all the various renewable surface resources of the National Forest System so that they are utilized in the combination that will best meets the needs of the American people" (36 CFR 219.3). The alternatives presented herein represent different ways of managing Tongass National Forest resources in combinations that are intended to meet the needs of the American people. The potential restrictions associated with each alternative are necessary and consistent with the sound management of public lands.

Amount of Public Land Necessary to Accomplish the Proposed Action: The amount of land necessary to implement each alternative is, considering sound multiple-use management of public lands, the minimum necessary to accomplish the purpose of that alternative. The entire forested portion of the Tongass is used by at least one rural community for subsistence purposes for, at a minimum, deer hunting. It is not possible to avoid all of these areas in implementing resource use activities, such as timber harvesting and road construction, under any alternative, and attempting to reduce effects in some areas can mean increasing the use of others. The current Forest-wide Standards and Guidelines and LUD prescriptions provide for management or limit activities in many of the area’s most important for subsistence uses, such as beaches and estuaries, and areas with high fish and wildlife habitat values.

Reasonable Steps to Minimize Adverse Impacts to Subsistence Uses and Resources: Subsistence use is addressed specifically in the 2008 Forest-wide Standards and Guidelines, and subsistence resources are covered by the Forest-wide Standards and Guidelines for wildlife, fish, riparian areas, and biological diversity, among others. Fish and wildlife habitat productivity would be maintained at the highest level possible under all alternatives, consistent with the overall multiple-use goals of the current Forest Plan, with improved protection under the Forest Plan.

Issue 4: Cumulative Watershed Effects

Issue statement: *The proposed action combined with past timber harvest would increase the percentage of each watershed area covered by timber harvest and would increase road densities in each watershed, potentially resulting in higher rates of sedimentation and/or other effects on aquatic habitats.*

Introduction

The identified issues and concerns relevant to watershed resources within the Big Thorne project area were developed based on external scoping comments from the public and internal review. The primary issues/concerns surrounding these resources are related to the intensity of past harvest and road construction in the project area and the potential cumulative effects on watersheds and fish associated with additional harvest. The project area includes a number of streams with high fisheries value that are located in watersheds with histories of intensive harvest and road construction. The interdisciplinary team identified Issue 4 and developed Alternative 5 in response to cumulative watershed effects concerns.

Direct, indirect, and cumulative effects for all affected watersheds are estimated using quantifiable surrogates for actual effects (e.g., stream crossings are a measure for increased sediment) as supported by the literature cited. Table WTR-1 lists the surrogates used to evaluate the effects of the proposal and compare alternatives.

Table WTR-1. Watershed Issues/Concerns Addressed and Environmental Components Analyzed for the Big Thorne Project Area

Issue/Concern	Environmental Component	Surrogate or Indicator
Cumulative Effects of Harvest and Road Construction on Watersheds	· Changes in streamflow	· Watersheds with more than 20 percent basin area harvested from 1981 through project implementation (young growth 30 years of age or younger)
	· Increased sediment	· Existing and new miles and acres of road construction by watershed · Existing and new numbers of Class I, II, and III stream crossings by watershed
	· Changes in stream habitat	· Existing and new numbers of Class I and II stream crossings by watershed

Methodology

The project area boundary does not coincide with watershed boundaries; therefore, the analysis area for direct, indirect, and cumulative effects includes all watersheds with any proposed ground disturbance in any alternative. This allows for watershed-level analysis of effects resulting from project actions.

To effectively analyze the direct, indirect, and cumulative effects of harvest and road construction on watersheds in the project area, and to utilize available assessments at finer subwatershed scales, project effects and alternative comparisons were conducted at both watershed and subwatershed scales. Watershed and subwatershed polygons at both scales were clipped to the land area, eliminating marine area from the analysis.

Although analyses were conducted at both the watershed and subwatershed scales, to succinctly describe the effects resulting from project actions at a finer scale, project effects and alternative comparisons are reported at the subwatershed scale. When effects resulting from project actions were found at the watershed scale, those results are provided. The complete detailed analyses of project effects and alternative comparisons at both the watershed and subwatershed scale are provided in the Watershed Resource Report (James 2013).

Information sources used in the analyses include field reconnaissance surveys conducted in the project area between 2009 and 2012, available literature, and geographic information system (GIS) data. Forest Service watershed and fisheries staff conducted field reconnaissance of the proposed roads and units between 2009 and 2012, resulting in updates to the streams layer and detailed records of erosion features, windthrow, and other relevant observations. Proper Functioning Condition (PFC) assessments (BLM 1998) and roads surveys were conducted by USDA Forest Service watershed and fisheries staff in the Eagle Creek (Fryxell 2010), North Thorne River (USDA Forest Service 2006d; Beard 2011), and North Big Salt Lake (also known as “Steelhead”) (USDA Forest Service unpublished document 2010a) watersheds, and the Gravelly Creek (USDA Forest Service 2006d; Beard 2011), Falls Creek (USDA Forest Service 2006d ; Beard 2011), and Sal Creek (Prussian 2008) subwatersheds. Tier II stream surveys were conducted by Forest Service watershed and fisheries staff in the Eagle Creek, Sal Creek, Big Ratz and North Thorne River watersheds. Tier II surveys are intended to provide consistent, quantitative estimates of habitat parameters that are required in order to evaluate the condition of a stream relative to the Riparian Habitat Management Objectives (RHMOs). The Tier II surveys include measurements of channel morphology, pools, ponded areas, large wood, disturbance, stream buffers, floodplain characteristics, fish presence and migration barriers (USDA Forest Service 2001a).

GIS queries were used to evaluate effects and compare alternatives, and provide surrogate measures of effects, supported by literature cited. Harvest and road indicator thresholds are used for analysis purposes only and are not prescribed by the Forest Plan. More information on methodology is contained in the Watershed Resource Report (James 2013).

Road miles and harvest unit acres were estimated from continued USDA Forest Service micro-sales and the State’s 5-Year Schedule of Timber Sales (ADNR 2011) and included in calculations of cumulative harvest and roads in affected watersheds.

Affected Environment

The Big Thorne project area encompasses roughly 232,000 acres of north Prince of Wales Island in Southeast Alaska near Thorne Bay and Coffman Cove. Elevation ranges from sea level to over 3,800 feet in the southwest portion of the North Big Salt Lake (also known as “Steelhead”) watershed. Annual precipitation may exceed 100 inches, with the highest rainfall occurring during October and lowest in June. Individual storms vary dramatically over short distances and can produce intense rainfall and high winds.

The Big Thorne project area contains two distinct ecological subsections: Central Prince of Wales Till Lowlands and Central Prince of Wales Volcanics. The majority of the project area is characterized as Central Prince of Wales Volcanics, especially along the coast and headwaters of Thorne River. This terrain originated as rugged volcanic mountains. Subsequent glaciation carved steeply sloped U-shaped valleys (Nowacki et al. 2001). The lowlands around Thorne River are characterized as Central Prince of Wales Till Lowlands. This subsection developed gently undulating terrain under continental ice lobes. Slow moving palustrine and floodplain channel types are common on this landscape (Nowacki et al. 2001). Shallow lakes and ponds pockmark an intermixture of forested and non-forested bogs and fens.

There are 21 watersheds with at least part of their drainage within the project boundary (Figure WTR-1). Of these, eight watersheds have no proposed ground disturbance in any alternative. Because there would be no proposed ground disturbance in any alternative within these eight watersheds, and they would not be affected by project activities outside of their watershed boundaries, analysis of effects is limited to the 13 remaining watersheds with proposed ground disturbance.

There are 48 subwatersheds with at least part of their drainage within the project boundary (Figure WTR-2). Of these, 11 subwatersheds have no proposed ground disturbance in any alternative and would not be affected by the project. Because there would be no proposed ground disturbance in any alternative within these 11 subwatersheds, and they would not be affected by project activities outside of their subwatershed boundaries, analysis of effects is limited to the 37 subwatersheds with proposed ground disturbance. Table WTR-2 lists by name each of the subwatersheds with proposed ground disturbance in any alternative.

The majority of the 37 subwatersheds primarily flow directly into Clarence Strait between Coffman Cove and Thorne Bay, or into the Thorne River, which drains into Thorne Bay. A few of the subwatersheds draining directly into Clarence Strait are not true subwatersheds with single outlet streams; Baird Peak, Barren, North, North Sal, Ratz Harbor, and Tiny are frontal subwatersheds containing discrete first order streams that empty directly into saltwater. In addition, the Big Ratz, Little Ratz, No Name, Sal Creek, Cobble Creek, Salamander, Doughnut, Luck Point, Pin, and Slide Creek subwatersheds all directly flow into Clarence Strait. In the north end of the project area are the Eagle Creek subwatersheds, including Eagle Creek/Slide Creek, Luck Lake, and West Fork Luck Creek subwatersheds. Eagle Creek is the outflow of Luck Lake, which flows into Clarence Strait. In the southern end of the project area the Thorne Bay, Thorne, and Deer Creek subwatersheds drain directly into Thorne Bay. The Control Lake, East Fork North Thorne River, West Fork North Thorne River, Snakey Lakes Lowlands, Central Thorne River, Falls Creek, Gravelly Creek, Torrent, Goose Creek, Thorne Lake, and Rio Beaver Creek subwatersheds all drain into the Thorne River, which flows into the Thorne River Intertidal subwatershed as the outlet to Thorne Bay. The Lake Ellen and North Kasaan Bay Frontage subwatersheds drain directly into North Kasaan Bay. The North Big Salt Lake subwatershed drains into Big Salt Lake, which opens into San Alberto Bay.

Figure WTR-1. Watersheds within the Big Thorne Project Area

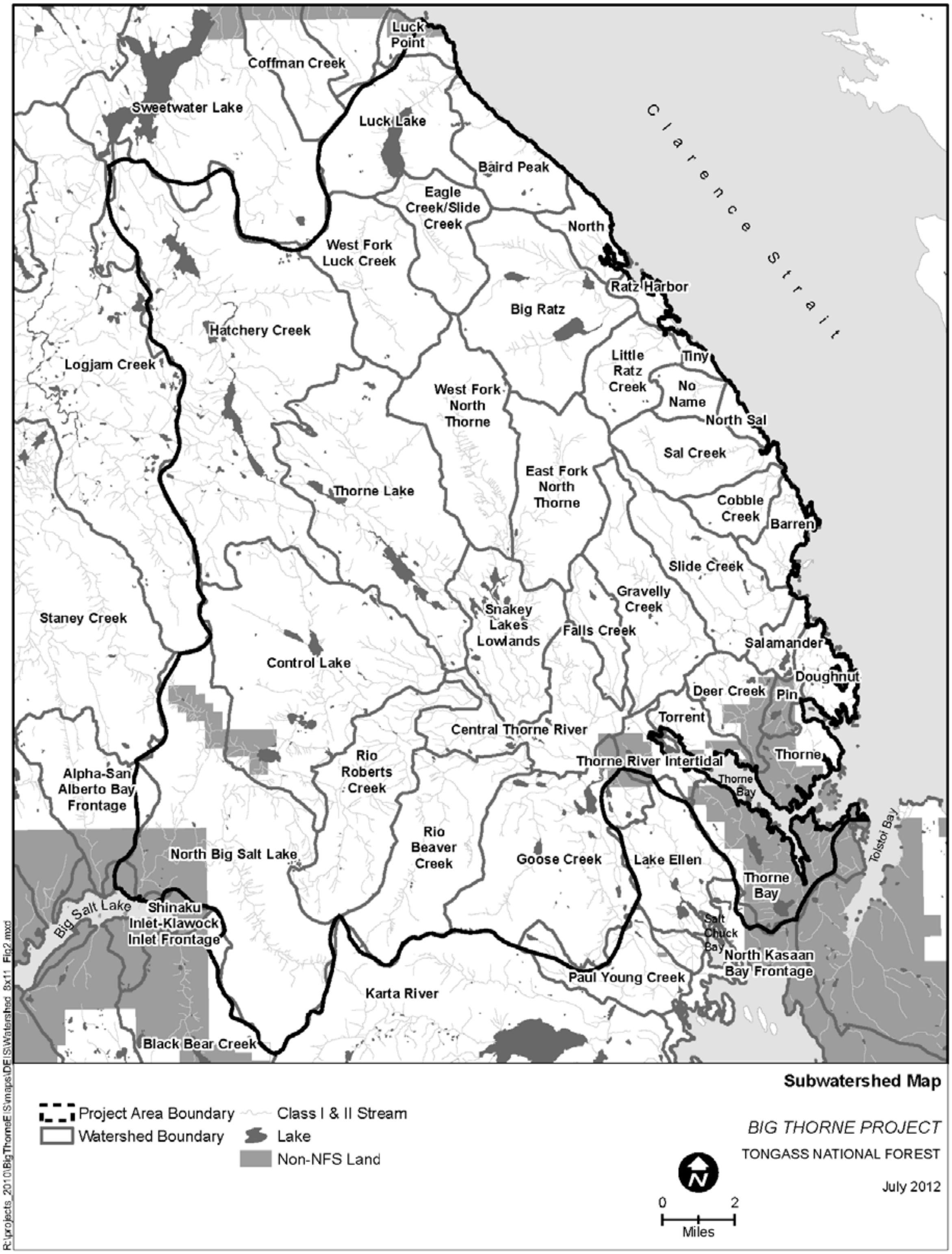

Figure WTR-2. Subwatersheds within the Big Thorne Project Area

Table WTR-2. Subwatersheds Affected by Big Thorne Project Alternatives

Subwatershed Name	Total Subwatershed Acres[1/]	Percent Non-NFS Lands in Subwatershed	Total Acres in Project Boundary	Percent Non-NFS Lands in Project Area	Percent of Entire Subwatershed in Project Boundary[2/]
Baird Peak	4,230	0	4,230	0	100
Barren	2,000	0	1,997	0	100
Big Ratz	10,299	0	10,299	0	100
Central Thorne River	6,986	1	6,986	1	100
Cobble Creek	2,137	0	2,137	0	100
Control Lake	18,624	4	18,611	4	100
Deer Creek	2,902	34	2,902	34	100
Doughnut	1,863	0	1,857	0	100
Eagle Creek/Slide Creek	4,556	0	4,556	0	100
East Fork North Thorne	7,548	0	7,548	0	100
Falls Creek	2,408	0	2,408	0	100
Goose Creek	13,502	4	12,422	2	92
Gravelly Creek	6,864	0	6,864	0	100
Lake Ellen	5,331	0	332	0	6
Little Ratz Creek	3,530	0	3,530	0	100
Luck Lake	7,499	0	7,183	0	96
Luck Point	1,410	36	674	12	48
No Name	1,556	0	1,556	0	100
North	2,031	0	2,024	0	100
North Big Salt Lake	20,299	16	19,928	16	98
North Kasaan Bay Frontage	14,707	71	212	1	1
North Sal	688	0	688	0	100
Pin	857	84	857	84	100
Ratz Harbor	828	0	827	0	100
Rio Beaver Creek	9,050	0	9,013	0	100
Sal Creek	4,644	0	4,643	0	100
Salamander	1,289	1	1,289	1	100
Slide Creek	6,485	0	6,485	0	100
Snakey Lakes Lowlands	6,645	0	6,645	0	100
Thorne	2,509	61	2,508	61	100
Thorne Bay	6,358	88	5,480	75	86
Thorne Lake	16,110	0	16,110	0	100
Thorne River Intertidal	1,810	41	1,628	36	90
Tiny	529	0	527	0	100
Torrent	1,807	21	1,806	21	100
West Fork Luck Creek	7,317	0	7,278	0	99
West Fork North Thorne	8,382	0	8,382	0	100

1/ Subwatershed areas were clipped to land area and do not contain marine acres.
2/ The "Percent of Entire Subwatershed in Project Boundary" is less than 100 percent but greater than 99.5 percent for those subwatersheds where the "Total subwatershed Acres" and "Total Acres in Project Boundary" are different, but the "Percent of Entire Subwatershed in Project Boundary" rounds to 100.

Fourteen of the 37 subwatersheds with ground disturbance in any alternative are part of the larger Slide Creek – Frontal Clarence Strait watershed (Baird Peak, Barren, Cobble Creek, northeastern portion of Doughnut, Little Ratz Creek, Luck Point, No Name, eastern portion of North, North Sal, Ratz Harbor, Sal Creek, Salamander Creek, Slide Creek, and Tiny). This watershed is a USDA Forest Service priority watershed and was rated as "functioning-at risk" using the Watershed Condition Framework (USDA Forest Service 2011c, 2011d). The "functioning-at risk" ranking is a national ranking based on assessments of watersheds within the National Forest Service system that were completed as part of an effort to prioritize watersheds for restoration actions. Major contributors to this ranking include previous harvest of riparian vegetation, density and proximity of roads to streams, as well as presence of contaminated soils. The Watershed Resource Report (James 2013) contains more detailed watershed and subwatershed descriptions. The subsequent sections describe the existing conditions for streamflow, water quality, sediment and turbidity, temperature, stream habitat, and lake habitat.

Streamflow

U.S. Geological Survey (USGS) stations provide the only available long term streamflow records near the project (USGS 2011). The hydrographs (Figure WTR-3) display mean monthly streamflow in cubic feet per second (CFS) normalized for drainage area in square miles for the station near the mouth of Staney Creek (USGS Staney Creek near Klawock 15081497, 50.6 square miles) and in the headwaters of the North Fork of Staney Creek (USGS North Fork Staney Creek near Klawock 15081495, 3.07 square miles). The hydrographs represent the typical annual streamflow regimes observed in all the affected watersheds and subwatersheds. A small snowmelt peak in spring is followed by low flows during drier summer weather when groundwater storage is depleted. Large rainstorms in fall produce the highest peak flows. Peak flows also occur in winter during rain-on-snow events.

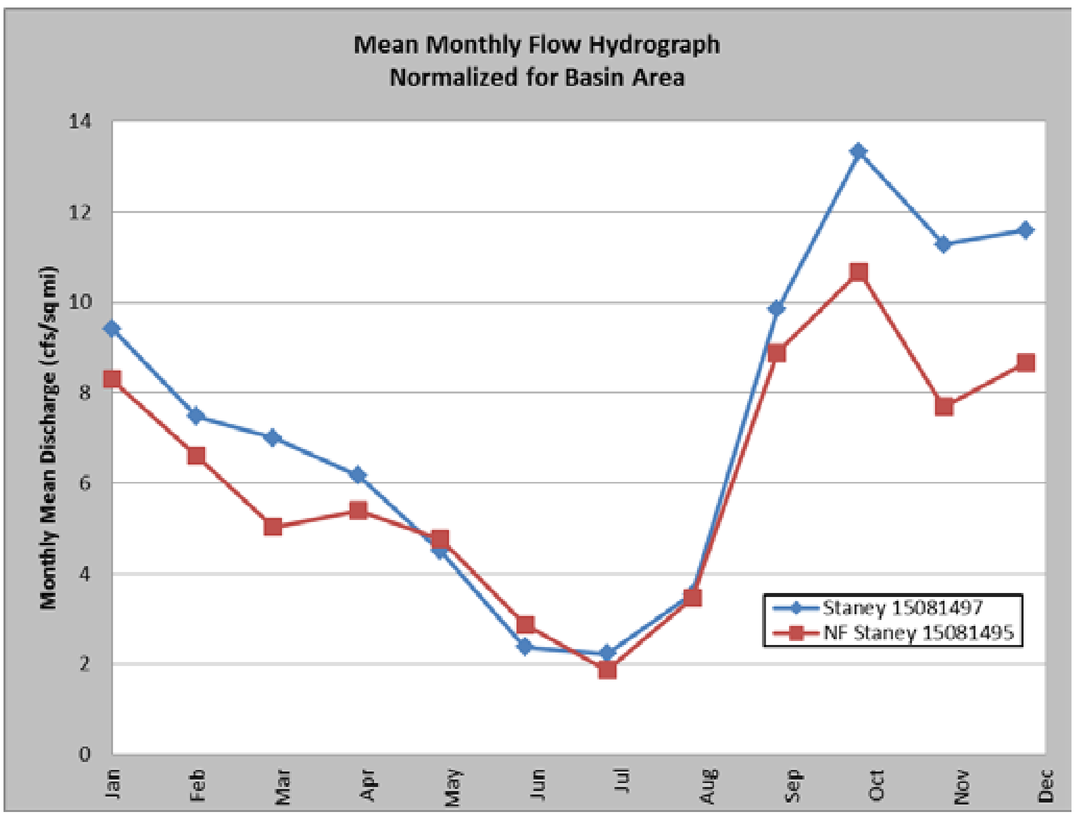

Figure WTR-3. Typical Streamflow Regime in Watersheds and Subwatersheds Affected by Big Thorne Project Alternatives

Timber harvest changes streamflow by altering processes that control the amount and timing of water delivered to streams. The direct removal of forest canopy affects rain interception (Prussian 2010), evapotranspiration, snow storage, snow melt, and soil moisture (Jones and Grant 1996; Hubbart et al. 2007). After harvest is completed, soil moisture and transpiration changes continue in response to uptake and use of water by remaining and regenerating vegetation.

Commercial and PCT methods are used within the Tongass National Forest in an effort to accelerate old-growth characteristics in otherwise overly dense timber stands. Commercial thinning would remove trees of commercial harvest size while also releasing remaining trees from overcrowded conditions in an effort to accelerate growth and improve conditions for future commercial harvest and resource values. Pre-commercial thinning involves cutting young trees within an area and leaving them in place. No removal occurs with PCT. Impacts of commercial thinning on streamflow are dependent upon local conditions, as well as the methodology and intensity of the thinning operations. The results of studies on timber harvest and flow relationships are highly variable (Scherer and Pike 2003). Some research has shown significant differences in peak flow responses between partial-cut and clear-cut watersheds. Keppeler et al. (2003) found that a 65 percent partial-cut watershed had minimal peak flow increases, while a 50 percent clear-cut watershed had increases up to 300 percent. Grant et al. (2008) found that detections of increases in peak flow did not occur until 29 percent of a basin is harvested for rain-dominated systems. Using their model results, they further propose that 40 percent thinning harvest evenly distributed over 100 percent of the basin area would likely result in a non-detectable peak flow increase in rain-dominated systems.

Changes in streamflow following timber harvest and road building are commensurate with the proportion of watershed harvested (Harr 1986; Jones and Grant 1996; Jones 2000; Moore and Wondzell 2005). Bosch and Hewlett (1982) suggested a threshold effect at 20 percent of basin area harvested. Because no baseline (pre-harvest) streamflow data are available for the affected watersheds, this conservative threshold of cumulative harvest suggested by Bosch and Hewlett (1982) was used to assess the potential changes in streamflow resulting from past management. Specifically, watersheds with at least 20 percent area in young growth less than 30 years of age (as shown in the right hand column of Table WTR-3) may have experienced streamflow changes. Another more recent "state of the science report" on peak flow response to timber harvest (Grant et al. 2008) establishes a minimum, cumulative harvest/stream flow response threshold of 20 to 40 percent over a 5-year time span. Climate cycles also influence streamflow and probably confound most of these studies, which have not occurred over long enough timeframes to account for climate shifts (USGS 2000, 2010; Neal et al. 2002). The Watershed Resource Report (James 2013) discusses other studies considered.

Peak flow increases in the affected watersheds are probably more likely than low flow increases, based on most of the studies in the Pacific Northwest. Although studies have suggested forest canopy recovery occurs in 10 to 30 years (Jones and Grant 1996; Jones 2000, Prussian 2010), for this analysis it is assumed that forest canopy recovery occurs in 30 years (since 1981) (Hicks et al. 1991; Jones 2000) and would be instrumental in recovery of pre-harvest rainfall interception (Prussian 2010). The Watershed Resource Report (James 2013) contains more information on these studies.

Table WTR-3. Past Harvest in Subwatersheds Affected by Big Thorne Project Alternatives

Subwatershed Name	Total Harvested (Acres)	Total Harvested (Percent Basin Area)	Total Harvested since 1981 (Acres)	Total Harvested since 1981 (Percent Basin Area)
Baird Peak	276	7	19	0
Barren	272	14	124	6
Big Ratz	3,050	30	1,017	10
Central Thorne River	1,207	17	721	10
Cobble Creek	778	36	199	9
Control Lake	645	3	645	3
Deer Creek	2,013	69	256	9
Doughnut	54	3	0	0
Eagle Creek/Slide Creek	1,812	40	338	7
East Fork North Thorne River	1,197	16	456	6
Falls Creek	771	32	218	9
Goose Creek	2,018	15	1,890	14
Gravelly Creek	2,962	43	649	9
Lake Ellen	1,805	34	953	18
Little Ratz Creek	1,173	33	238	7
Luck Lake	2,669	36	1,038	14
Luck Point	222	16	150	11
No Name	204	13	204	13
North	515	25	118	6
North Big Salt Lake	4,528	22	4,210	21
North Kasaan Bay Frontage	4,779	32	4,033	27
North Sal	103	15	53	8
Pin	103	12	63	7
Ratz Harbor	171	21	34	4
Rio Beaver Creek	2,509	28	594	7
Sal Creek	1,546	33	392	8
Salamander	548	42	70	5
Slide Creek	3,713	57	628	10
Snakey Lakes Lowlands	1,097	17	885	13
Thorne	210	8	101	4
Thorne Bay	3,446	54	1,151	18
Thorne Lake	387	2	387	2
Thorne River Intertidal	966	53	107	6
Tiny	161	30	27	5
Torrent	999	55	149	8
West Fork Luck Creek	2,035	28	649	9
West Fork North Thorne	1,551	19	464	6

The North Big Salt Lake (also referred to as "Steelhead") and North Kasaan Bay Frontage subwatersheds (shaded in Table WTR-3) exceed the 20 percent area harvested since 1981 threshold. Streams in these drainages may currently have increases in peak flows, especially when considering the combined effects of stream network extension by roads (see sediment and turbidity section below) in these subwatersheds. If no further harvest occurs in these subwatersheds, they would reach a state of hydrologic recovery, based on forest canopy, by 2015 for the North Big Salt Lake subwatershed and by 2023 for the North Kasaan Bay Frontage subwatershed.

At the watershed scale, the Slide Creek – Frontal Clarence Strait watershed does not exceed the 20 percent area harvested since 1981 threshold (9 percent basin area harvested since 1981). However, the North Big Salt Lake and Tolstoi Bay – Frontal Clarence Strait watersheds exceed the 20 percent area harvested since 1981 threshold (21 and 27 percent basin area harvested since 1981, respectively). Streams in the North Big Salt Lake and Tolstoi Bay – Frontal Clarence Strait watersheds may currently have increases in peak flows, especially when considering the combined effects of stream network extension by roads (see sediment and turbidity section below) in these watersheds. If no further harvest occurs in these watersheds, they would reach a state of hydrologic recovery, based on forest canopy, by 2015 for North Big Salt Lake watershed and the late-2020s for Tolstoi Bay – Frontal Clarence Strait watershed. The Watershed Resource Report (James 2013) discusses all watersheds in more detail.

In summary, past harvest (including harvest prior to 1981) may have caused increased streamflow at the subwatershed scale in 22 of the affected subwatersheds. Two of these, the North Big Salt Lake and North Kasaan Bay Frontage subwatersheds, may currently experience increased flows. A 10 percent increase in peakflow at the subwatershed scale (Grant et al. 2008) is plausible; however, the body of supporting science on this issue has contributed to variable conclusions and it is unlikely that an increase could be measured due to the lack of baseline data in the affected subwatersheds.

Water Quality

Beneficial Uses of Waters on the Project Area

Water bodies in Alaska are protected for all uses; the most stringent numeric criteria apply in accordance with Alaska Water Quality Standards (ADEC 2011a). For stream temperature, the most stringent criterion is aquatic life and for turbidity it is drinking water. Existing uses of water from the subwatersheds in the project area include potable water supplies, aquatic life, and limited contact recreation.

There are two potable water supplies (PWS) in the affected subwatersheds—Water Lake and Linkum Creek—and neither would be affected by the Big Thorne Project because no activities are proposed in their source watersheds.

Two MAFs are likely to be used for log transport as part of project activities: Thorne Bay and Coffman Cove. The Thorne Bay MAF is a former LTF and is considered an impaired waterbody due to bark deposits. Coffman Cove is not considered an impaired waterbody.

Impaired Waterbodies

The Watershed Resource Report (James 2013) contains definitions for categories of Impaired Waterbodies. There are two marine areas adjacent to the project area that meet ADEC Division of Water criteria (2010) for impaired waterbodies: Thorne Bay and Salt Chuck Bay.

Within Thorne Bay, there are 7.5 acres listed as Category 4a due to bark and wood debris residues from historic log rafting at log transfer facilities in this marine area. Although there have been improvements in water quality and the amount of debris residue in this area, due to its impaired status, the area is a barge-only site. There are three subwatersheds with proposed harvest activities that are adjacent to Thorne Bay (the

Torrent, Thorne River Intertidal, and Thorne Bay subwatersheds). In addition, there is potential for this site to be utilized during the Big Thorne Project, as this is a permitted MAF. All permits are currently up-to-date for log transfer and barging operations that would be associated with its use for the project.

Within Salt Chuck Bay, 19.2 acres are listed as Category 5 due to toxic and other deleterious organic and inorganic substances and pollutant parameters for copper from historic mining activity and tailings that were left on site. This marine area is adjacent to the Lake Ellen subwatershed. Provided in the Contaminated Sites section below is additional information on contaminants and remediation efforts at Salt Chuck Mine.

Contaminated Sites

Contaminated sites are defined as locations polluted with hazardous materials that have been disposed of or stored improperly (ADEC 2011b) and have the potential to threaten human health. The ADEC Division of Spill Prevention and Response Contaminated Sites Program provide a database of contaminated sites. For the watersheds and subwatersheds within the project area, the database includes 11 contaminated sites: five completed site cleanups, two completed site cleanups with institutional controls, and four sites remain open. The USDA Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, USDA Forest Service Salt Chuck Mine, and USDA Forest Service Thorne Bay Landfill are the four sites that remain open.

The USDA Forest Service Thorne Bay Warehouse Historic Spills and Thorne Bay DuRette Shop sites are located within the town of Thorne Bay. The USDA Forest Service Thorne Bay Warehouse Historic Spills site contains petroleum and metal contaminated materials. The Thorne Bay DuRette Shop site is a historical waste oil sump with petroleum contaminated soils.

The Salt Chuck Mine is a historic gold, silver, copper, and palladium mine located in the Lake Ellen subwatershed and is 4.5 miles south of the town of Thorne Bay. Contaminants include the remnants of 25 structures, two diesel tanks and four banks of diesel engines on site, and a tailings deposit covering approximately 23 acres from the intertidal zone to the uplands. An additional 45 acres of uplands have been contaminated by mining-related activities. The main contaminants of concern are copper, arsenic, and vanadium. In 2010, the Salt Chuck Mine was added by the Environmental Protection Agency (EPA) to its National Priorities List, resulting in the site being under CERCLA (Comprehensive Environmental Response, Compensation and Liability Act, otherwise known as Superfund) authority (ADEC 2011c). During 2011, the Forest Service began cleanup and remediation activities on Federal lands within the upland area. Remediation activities included the construction of a temporary road to the site, the removal of approximately 5,400 cubic yards of petroleum and metal contaminated soils and tailings to an out of state landfill, and the removal of building debris and tanks. These remediation activities will likely contribute to improved water quality in Salt Chuck Bay over time, by lowering the levels of copper, arsenic, and vanadium. Additional removal activities on Federal lands are anticipated to be addressed under the EPA Superfund action. Testing was done in the winter of 2011 followed by continued remediation in the summer of 2012.

The Forest Service Thorne Bay landfill is located in the Torrent subwatershed and is 1.5 miles west of the City of Thorne Bay. The landfill is comprised predominately of solid waste, but hazardous wastes such as paint, waste oil, old gas, diesel fuel, batteries, paint thinner, waste solvent, PCB transformers, and arsenic-based pesticides have also been dumped in the area. Metals are reported to be leaching from the site into nearby waterways. Three streams drain the landfill site, two of which—Ditch Creek and South Creek—are fish bearing. Ditch Creek runs through the northern edge of the landfill, and South Creek through the middle. In 2002, iron and manganese were found in Ditch Creek and South Creek. Due to the presence of the hazardous waste, under CERCLA authority, the Forest Service conducted an engineering Removal Action and NFRAP ("No Further Remedial Action Planned") with long-term monitoring required. Annual monitoring of surface water for iron and manganese, as well as fish surveys for 10 years, was required with a 5-year review.

In 2009, the 5-year review was conducted and results demonstrated that the sampling locations in Ditch Creek, closest to the Thorne Bay Estuary, met water quality standards for iron and manganese for 5 years, and no additional sampling was needed at those locations (ADEC 2011d). Within South Creek, Alaska Water Quality Standards exceedences for iron and manganese were observed and monitoring remained necessary. Due to the lack of established trends, fish monitoring was eliminated at all sampling locations.

Acid Rock Drainage

Acid rock drainage (ARD) is created when iron pyrite, oxygen, and water combine and produce acidified water that dissolves metal compounds resulting in elevated metal concentrations in the water. The ARD acronym is used for rock containing sulfides such as iron pyrite that break down and produce acidified water.

The Coffman Cove Road project, a Federal Highways project north of the Big Thorne Project boundary, utilized a rock source from the Descon Formation for a portion of the construction. The Descon Formation is an Ordovician- to Silurian-aged black, thin-bedded shale and/or chert. The use of this pyritic material in the road's subgrade resulted in the generation of ARD which negatively impacted water quality and aquatic environments downstream of the construction. Subsequent testing of the waters above the Coffman Cove Road cleanup effort showed some metal values exceeding Alaska State Water Quality Standards. This suggests that mineralization exists in other zones within the watersheds (Baichtal personal comm. 2011, as cited in Barnhart and Hitner 2013b). As a result, five unnamed tributaries to Sweetwater Lake, outside of the Big Thorne project area, were included in the State of Alaska's 2010 Integrated Report as Category 5 Waterbodies (listed as impaired waterbodies according to CWA Section 303(d)). Ongoing monitoring of the streams suggest that ARD-related constituents in these streams have shown steadily declining trends over time and they are currently recovered to a level likely to result in their removal from this listing (AMEC 2012, 2011, 2010; Big Thorne Project record documents).

Approximately 15.2 percent (35,074 acres) of the Big Thorne project area is underlain by the Descon Formation. Most of the Descon Formation (Sod) area contains disseminated pyrite. Some shear and fault zones within this formation are more heavily mineralized than others. The use of this pyritic material in the road's subgrade can result in the generation of "acid rock drainage" (ARD), which can negatively impact water quality and aquatic environments downstream of the construction. Existing forest roads and quarries in this area are constructed from the Descon Formation. It is estimated that 253.8 miles of existing road likely constructed from the Descon Shale exist within the Big Thorne project area. It is not known if the material sources used in this construction contained mineralization. However, no past problems have been observed (Baichtal personal comm. 2011, as cited in Barnhart and Hitner 2013b).

Sediment and Turbidity

Limited sediment and turbidity information has been collected in some of the affected subwatersheds and is summarized in this section.

Sediment is introduced into streams by channel erosion, roads, landslides and debris flows, and rain splash on bare soils. The amount of sediment delivered to streams is influenced by road construction, road drainage, road-use frequency, number of road-stream crossings, subwatershed road density, and management actions in forested drainages (Reid and Dunne 1984; Swanson et al. 1987; Chamberlin et al. 1991; Furniss et al. 1991; Croke et al. 2005; Gomi et al. 2005). Although riparian buffer zones in watersheds are considered to be sediment sinks, under some circumstances, buffer zones may be sediment sources (Dillaha and Inamdar 1997). Gomi et al. (2005) reviewed studies related to the effects of timber harvest on sediment production and discusses that increased peak flow response due to vegetation loss may increase sediment recruitment from within-channel sources and transport capacity of streams. Because increased peak flows may increase sediment recruitment from stream channel erosion and bed scour (Tonina et al. 2008), stream channel erosion could be increased within subwatersheds containing 20 percent or greater area harvested since 1981 (30 years) (Table WTR-3).

The effects of commercial thinning on sediment production are dependent upon multiple factors, including area of basin harvested, hydrologic regime, topography, soil conditions, and harvest methods. Karwan et al. (2007) found that sedimentation effects from a partial-cut of 50 percent of a watershed were insignificant when compared to the control, while effects from 50 percent clear-cut harvest were significant.

Forest-wide BMP implementation monitoring has consistently reported a high level of compliance (USDA Forest Service 2012d). BMP implementation monitoring will continue to occur annually on a representative basis across the forest as part of Forest Plan monitoring and is likely to occur in the Big Thorne project area. In addition, a range of Forest Plan monitoring measures will occur at the forest level and may or may not take place in the Big Thorne project area.

BMP implementation and effectiveness monitoring occurred at recent timber harvest sites on Prince of Wales Island and in most cases, BMPs were found to be implemented appropriately (USDA Forest Service 2011e). Examination of five harvest units and related roads by an interdisciplinary team found effective implementation of the BMPs with no visual sign of erosion or sedimentation into site area streams (USDA Forest Service 2011e). This further suggests that increased stream sediment from present harvest practices would be minimal.

Roads have been found to contribute more sediment to streams than any other land management activity (Reid and Dunn 1984; Gucinski et al. 2001; Gomi et al. 2005) and pose the greatest potential risk to watershed resources and fish habitat (Furniss et al. 1991;

Luce and Wemple 2001). Timber harvest and road construction on unstable slopes may trigger landslides and debris flows. The delivery of sediment to streams from these events depends on their connection to streams (Gomi et al. 2005).

Landslides resulting from disturbance can contribute significant amounts of sediment and may occur due to disturbances from harvest operations that are unrelated to the basin area harvested (Kreutzweiser and Capell 2001). Landslide inventories were completed in the project area and natural and management-induced landslides and other sediment sources are described in the Soils (Cox et al. 2013) and Karst (Kovarik 2013) Resource Reports. Naturally caused landslides affect approximately 1.4 percent of the project area and a total of 2.1 percent of the project area has naturally disturbed soils (Cox et al. 2013). Approximately 0.2 percent of the project area is affected by landslides resulting from previous harvest activities. Past harvest on steep slopes greater than 72 percent may also contribute to mass wasting events; however, most past harvest did not occur on slopes greater than 72 percent. Total soil disturbance due to management affects 2.3 percent of the project area. Roads are associated with 61 (56 acres) management-related landslides (Cox et al. 2013). Further details on landslides are discussed in the Watershed Resource Report (James 2013).

Road construction in Southeast Alaska requires substantial ground disturbance, producing short-term increases in sediment transport (Paustian 1987). Road reconstruction, maintenance, and storage activities also mobilize sediment. These periodic short-term increases would have occurred in each of the affected watersheds and subwatersheds starting around the 1950s and continuing through current road construction and maintenance activities.

Studies in Southeast Alaska have correlated higher rates of road erosion with heavy traffic and poor-quality rock surfacing (Kahklen and Hartsog 1999). In Washington's Olympic Peninsula, Cederholm et al. (1980) found that accumulation of fine sediment in streambeds was highest in basins where the road area exceeded 2.5 percent of the basin area. A statistical relationship between fine streambed sediment and watershed disturbance has not been reported in Southeast Alaska studies (Bryant et al. 2004; Woodsmith et al. 2005). Nonetheless, the suggested threshold by Cederholm et al. (1980) provides a measure to evaluate the potential impacts of roaded areas in the affected watersheds and subwatersheds in comparison to findings elsewhere in the Pacific Northwest.

The Deer Creek, Ratz Harbor, Salamander, Slide Creek, Thorne River Intertidal, and Torrent subwatersheds exceed the 2.5 percent threshold within the Big Thorne project area (as shown in the right hand column of Table WTR-4). In an assessment of 17 subwatersheds located within the Big Thorne project area, the Big Ratz, Sal Creek, and Slide Creek subwatersheds were determined to have the highest sediment movement potential and detrimental effects from past management activities based on stream density and miles of transport streams (USDA Forest Service 2004a). In an additional assessment of these 17 subwatersheds, Prussian and Bair (2006) ranked the Big Ratz, No Name, Deer Creek, Slide Creek, Ratz Harbor, and Torrent subwatersheds highest for potential sediment impacts to aquatic resources. Through an assessment and field reconnaissance, Fryxell (2010) ranked the Eagle Creek/Slide Creek, Luck Lake, and West Fork Luck Creek subwatersheds as high for sediment risk and landslide influences on fish habitat. In addition, the Sal Creek and Slide Creek subwatersheds have sediment sources due to landslides and drainage issues related to roads (Thompson and Brigham personal comm. 2012). Furthermore, increased peak flows associated with past harvest (Table WTR-3) could be resulting in stream channel erosion contributing to accumulations of fine sediment in streambeds.

Based on minimum clearing widths and road surface specifications, a width of 40 feet was used to estimate area of road surface and cut slope contribution to erosion and sediment within each watershed and subwatershed. Table WTR-4 summarizes existing roads in subwatersheds affected by the Big Thorne Project alternatives.

Table WTR-4. Existing Roads in Subwatersheds Affected by Big Thorne Project Alternatives

Subwatershed Name	Total Basin Size (Acres)	Total Existing Roads[1/] (Miles)	Total Existing Roads[1/] (Acres)	Percent of Basin as Roads[2/]
Baird Peak	4,230	2.0	9.8	0.2
Barren	2,000	7.5	36.2	1.8
Big Ratz	10,299	29.0	140.4	1.4
Central Thorne River	6,986	19.9	96.7	1.4
Cobble Creek	2,137	7.8	37.6	1.8
Control Lake	18,624	22.7	110.2	0.6
Deer Creek	2,902	19.0	92.1	3.2
Doughnut	1,863	0.0	0.0	0.0
Eagle Creek/Slide Creek	4,556	12.5	60.8	1.3
East Fork North Thorne River	7,548	14.3	69.2	0.9
Falls Creek	2,408	9.0	43.5	1.8
Goose Creek	13,502	34.9	169.0	1.3
Gravelly Creek	6,864	28.5	138.1	2.0
Lake Ellen	5,331	24.1	116.8	2.2
Little Ratz Creek	3,530	9.7	47.2	1.3
Luck Lake	7,499	25.7	124.5	1.7
Luck Point	1,410	3.4	16.4	1.2
No Name	1,556	5.7	27.4	1.8
North	2,031	6.5	31.7	1.6
North Big Salt Lake	20,299	59.0	286.2	1.4
North Kasaan Bay Frontage	14,707	56.3	272.8	1.9
North Sal	688	2.0	9.7	1.4
Pin	857	3.8	18.2	2.1
Ratz Harbor	828	4.5	21.8	2.6
Rio Beaver Creek	9,050	31.0	150.3	1.7
Sal Creek	4,644	14.0	67.8	1.5
Salamander	1,289	7.6	37.0	2.9
Slide Creek	6,485	37.1	179.9	2.8
Snakey Lakes Lowlands	6,645	14.3	69.5	1.0
Thorne	2,509	1.8	8.7	0.3
Thorne Bay	6,358	31.4	152.2	2.4
Thorne Lake	16,110	7.7	37.1	0.2
Thorne River Intertidal	1,810	9.4	45.8	2.5
Tiny	529	2.2	10.7	2.0
Torrent	1,807	16.8	81.5	4.5
West Fork Luck Creek	7,317	18.2	88.1	1.2
West Fork North Thorne	8,382	11.7	56.5	0.7

1/ Includes all roads (open/stored/decommissioned) in and out of harvest units. Paved highway and non-Forest Service roads are also included in this analysis.
2/ Rows for subwatersheds with greater than 2.5 percent or more covered by roads are shaded in table.

At the watershed scale, the Slide Creek – Frontal Clarence Strait watershed does not exceed the 2.5 percent threshold (1.6 percent of basin as roads). However, the Thorne Bay – Frontal Tolstoi Bay is the only watershed exceeding the 2.5 percent threshold (3.1 percent of basin as roads). Although this is the only watershed exceeding the 2.5 percent threshold, the Eagle Creek, Ratz Creek, and North Thorne River watersheds have sediment sources due to landslides and drainage issues related to roads (Thompson and Brigham personal comm. 2012). These inherent and management-induced sediment contributions could be degrading watershed conditions; however, the available data suggests sediment and turbidity ranges in the affected watersheds are within ranges observed in unmanaged watersheds and within the criteria established by the state. The Watershed Resource Report (James 2013) discusses all watersheds in more detail.

Road condition surveys in the project area were primarily completed from 1998 to 2002. However, portions of the road condition surveys are updated annually. In 2002 the Forest Service implemented Watershed Improvement Tracking to address restoration needs in the Central Thorne and Gravelly Creek subwatersheds. Forest Roads 3015105, 3015635, 3015639, 3016000, 3016300, 3016350, and 3017000 were found to have road disturbance, plugged culverts and gully erosion issues with a low priority for treatment. Forest Roads 30152600, 3015630, 3015635, and 3016100 were found to have road disturbance and gully erosion issues with a medium priority for treatment. Forest Roads 3015105_0.95L had road disturbance issues with a high priority for treatment. Recommended treatments in these subwatersheds included road decommissioning, scarifying and seeding, unplugging and removing culverts, and improving drainage (USDA Forest Service unpublished document 2002a). Most of these treatments have since been completed during road maintenance work. Three of these roads (3015630, 3106000, and 3016300) have been stored with type “C” treatment to specifically address water and erosion issues while roads 3016350 and 3016100 were also stored. Additionally, work has been done on three other roads (3015635, 3017000, and 3015600) with actions including ditch cleaning, brushing, and bridge repair that would aid in sediment issues. Additional work will continue as needed (Big Thorne Project record; Thompson, personal comm. 2013).

In the Deer Creek, Tiny, Sal Creek, and North subwatersheds, surveys identified sediment sources along roads. These include Forest Roads 2030000, 2030700, 3000000, 3015600, and 3025000. Repairs began in 2010 and will continue until recommended maintenance is complete (USDA Forest Service unpublished document 2010a, 2011).

From 2005 to 2007, various restoration efforts were implemented in the Sal Creek subwatershed. Roads were stormproofed and improved for drainage and six culverts were removed to improve fish passage (Prussian 2008). In 2011, repairs began in Sal Creek on Forest Road 3020000. Maintenance includes replacing culverts and clearing the ditch and road surface (USDA Forest Service unpublished document 2010b, 2011).

In monitoring installations of new stream structures within the Tongass National Forest, downstream turbidity following installation did not exceed state water quality standards (USDA Forest Service 2009c). Results from BMP implementation and effectiveness monitoring of a sample of 10 to 15 percent of roads constructed, stored, and decommissioned over the 4 years prior to 2010, as well as units harvested in 2010, found the Tongass National Forest is successfully implementing the Standards and Guidelines for protection of Soil and Water Resources in most cases (USDA Forest Service 2011e).

Although successful implementation of BMPs occurred, there were a few departures related to erosion control associated with seeding along road construction and decommissioned segments, stabilization of excavated banks, and removal of temporary culverts to provide fish passage at varied stream flows. The team conducting the monitoring noted that action plans include clarifications on implementation of the BMPs in road storage and road decommissioning road contracts (USDA Forest Service 2011e).

Tucker and Thompson (2010) conducted a comparison study related to management practices that included Shaheen Creek on Prince of Wales Island including two subwatersheds within the project area and concluded that the Forest Plan Standards and Guidelines are effective in maintaining water quality in Shaheen Creek. Furthermore, Tucker and Thompson (2010) results suggest that increases in turbidity (and sediment) within Shaheen Creek may not be measurable when compared to natural conditions, and if downstream increases were detected in the study, recovery to baseline level occurred without degrading water quality.

Alaska Water Quality Standards state that "Turbidity may not exceed 5 nephelometric turbidity units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than a 10 percent increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 25 NTU" (ADEC 2011a). Continuous turbidity monitoring at locations on Prince of Wales Island suggests that background turbidity, even in a heavily harvested watershed, is consistently near 0 NTUs, but can peak near 200 NTUs in both unharvested and harvested watersheds during storm events (Thompson and Tucker 2007). Although turbidity data are not available from most of the affected subwatersheds, the data from two subwatersheds in the project area suggest that turbidity ranges in the project area are within the criteria established by the state (Thompson and Tucker 2007).

In summary, the combined effect of percent basin in roads, sediment sources from landslides, drainage issues related to roads, and increased peak flows associated with past harvest could be increasing fine sediment deposition and contributing towards degraded subwatershed conditions in the Big Ratz, Deer Creek, Eagle Creek/Slide Creek, Luck Lake, No Name, Ratz Harbor, Sal Creek, Salamander, Slide Creek, Thorne River Intertidal, Torrent, and West Fork Luck Creek subwatersheds. Although these combined effects could be increasing sediment sources in the affected subwatersheds, the best available information suggests that sediment transport and turbidity within these subwatersheds are within natural ranges.

Temperature

Riparian vegetation intercepts and reduces the intensity of solar radiation to streams and reduces back-radiation during cold months (Platts 1991). Removal of riparian vegetation can increase stream temperature, but the magnitude of effects from management activities varies. In coastal British Columbia, daily maximum temperature in summer increased in streams with no buffer, while water temperature in streams with 10 and 30 meter buffers did not (Gomi et al. 2006). Riparian harvest occurred in all of the affected subwatersheds, except in the Doughnut, Luck Point, and North Sal subwatersheds (Table WTR-5) prior to 1991 (the year the Tongass Timber Reform Act of 1990 was implemented), even along fish streams. Past riparian harvest could have resulted in stream temperature increases during warm weather, but recovery of at least deciduous (alder) shade has likely occurred in these harvested riparian areas. The Watershed Resource Report (James 2013) discusses water temperature in watersheds and subwatersheds in more detail.

Table WTR-5. Past Riparian Harvest in Subwatersheds Affected by Big Thorne Project Alternatives

Subwatershed Name	Total Riparian (acres)[1/]	Total Riparian Harvested (acres)[1/]	Percent Riparian Harvested
Baird Peak	389	16	4
Barren	201	46	23
Big Ratz	1,576	547	35
Central Thorne River	1,774	90	5
Cobble Cree	210	84	40
Control Lake	4,003	58	1
Deer Creek	449	294	65
Doughnut	244	0	0
Eagle Creek/Slide Creek	730	465	64
East Fork North Fork Thorne River	1,428	437	31
Falls Creek	358	123	34
Goose Creek	1,874	126	7
Gravelly Creek	971	430	44
Lake Ellen	16	3	17
Little Ratz Creek	436	231	53
Luck Lake	1,598	437	27
Luck Point	47	0	0
No Name	163	18	11
North	212	91	43
North Big Salt Lake	7,148	838	12
North Kasaan Bay Frontage	99	26	27
North Sal	37	0	0
Pin	219	21	9
Ratz Harbor	70	20	28
Rio Beaver Creek	1,394	427	31
Sal Creek	601	337	56
Salamander	286	103	36
Slide Creek	955	516	54
Snakey Lakes Lowlands	1,697	83	5
Thorne	285	26	9
Thorne Bay	1,014	447	44
Thorne Lake	2,902	33	1
Thorne River Intertidal	306	189	62
Tiny	34	18	53
Torrent	175	103	58
West Fork Luck Creek	1,103	498	45
West Fork North Thorne	1,302	346	27

1/ Total riparian and riparian harvest acres were calculated using USDA Forest Service GIS information and includes all streams in watersheds on both Federal and non-Federal lands.

Evaluation of stream temperature data from both harvested and un-harvested watersheds on Prince of Wales Island showed no predictive relationship between harvest and high stream temperatures (USDA Forest Service 2004b; Walters and Prefontaine 2005). Additionally, Walters and Prefontaine (2005) found that the streams on Prince of Wales Island naturally exceed water quality temperatures. Tucker and Thompson (2010) conducted a comparison study that included Scary Creek (within the Rio Beaver Creek watershed) and a reference watershed (Chanterelle Creek, within the Rio Roberts watershed) with no timber harvest or roads. Based on this study, all drainages exceeded the most stringent numeric criteria of the Alaska Water Quality Standards for maximum stream temperature. Tucker and Thompson (2010) note that while Scary Creek contains upland and riparian harvest and roads, it usually experienced shorter duration exceedences and fewer days exceeding maximum temperature criteria than the reference stream. Hetrick et al. (1998) found that the main determinant of high stream temperatures was low flow. Due to Southeast Alaska's weather, when there is an increase in solar radiation, there is little precipitation, and therefore, lower discharge rates for streams. Likewise, when precipitation returns, stream discharge increases, resulting in lower radiation and stream temperatures.

The lack of a predictive relationship between harvest and elevated stream temperatures on Prince of Wales Island (USDA Forest Service 2004b; Walters and Prefontaine 2005), and implementation of riparian no-harvest buffers along Class I, II, and III streams for any future harvests, suggests that stream temperature is not likely to be measurably affected by harvest activities.

Stream Habitat

The Fisheries Resource Report describes the distribution and characteristics of streams throughout the affected subwatersheds (Knutzen 2013). The process groups used to classify and map streams in the project area reflect state of the art knowledge about inherent stream channel functions and processes affecting fish habitat (Paustian et al. 1992). The process groups also aid our understanding of the effects of past practices. In 2010, revisions were made to the channel types to facilitate in the logical determinations of channels types within the established process groups (Paustian and Kelliher 2010). The revised channel types were used during field surveys for the Big Thorne Project.

In the project area, all watersheds (Control Lake, Rio Roberts Creek, Rio Beaver Creek, Goose Creek, Thorne Lake, North Thorne River, and Outlet Thorne River) draining into the Thorne River, as well as the Eagle Creek and Ratz Creek watersheds, and the Sal Creek and Slide Creek subwatersheds contain the most sensitive anadromous fish streams (Knutzen 2013). In these channels, stream habitat complexity is dependent on a continuous supply of large wood from old growth conifer riparian forests. Wood provides essential cover and primary productivity. It is a key agent in scouring and maintaining stable pools in low gradient gravel bed streams (Maser and Sedell 1994).

Wood is also influential in fishless high gradient headwater streams, storing sediment and releasing it to downstream reaches over time (May and Greswell 2003; Gomi et al. 2001). These headwater streams are also important sources of organic material which supplies food to downstream fish populations (Wipfli and Gregovich 2002).

Widespread historic riparian harvest in the affected subwatersheds removed large old growth conifer trees, resulting in red alder-dominated forest along stream channels. Although alder provides shade and leaf litter important to primary productivity, it does not provide long-lasting large wood (Johnson and Edwards 2002). Current riparian conditions along stream channels are dominated by red alder with young conifers beginning to establish. Recovery of riparian vegetation to pre-harvest conditions of large coniferous trees could take decades.

PFC surveys are qualitative assessments of the hydrology, vegetation, and erosion/deposition characteristics of streams, and riparian areas. Information collected includes channel stability, large woody debris and other pool-forming features, riparian conditions, and geomorphological functions. PFC assessments were conducted for the North Big Salt Lake (commonly referred to as “Steelhead”) (USDA Forest Service unpublished document 2010a), Sal Creek (Prussian 2008), Gravelly Creek (USDA Forest Service unpublished document 2001, 2002b), and Falls Creek (USDA Forest Service unpublished document 2001) subwatersheds. In addition, PFC surveys were conducted for the Eagle Creek (Fryxell 2010) and North Thorne River watersheds (USDA Forest Service unpublished document 2002b). The Watershed Resource Report (James 2013) contains information on PFC assessments at the watershed scale.

In the North Big Salt Lake (also referred to as “Steelhead”) subwatershed, PFC assessments were done on three reaches of Steelhead Creek (USDA Forest Service unpublished document 2010a). One stream reach was determined to be “functioning-at risk,” due to past riparian harvest and a lack of large woody debris (LWD). A second section of the stream was also determined to be “functioning-at risk” due to bank erosion, past riparian harvest, and a lack of LWD. The third reach was determined in to be in “properly functioning condition.”

The Sal Creek subwatershed was determined to be in “properly functioning condition” based on PFC surveys conducted in 2002. Restoration and monitoring efforts have been ongoing in the Sal Creek subwatershed since the 1980s. The most recent restoration project occurred between 2006 and 2007 and entailed placing approximately 400 trees along 1.2 miles of mainstem channel, stormproofing and improving drainage on over 1.5 miles of logging road within the floodplain, removing six culverts that were impeding fish passage to over 1 mile of tributary streams, and thinning alder and conifers from over 75 acres of floodplain (Prussian 2008). Between 2004 and 2008, Tier II and III level surveys were used to monitor the LWD restoration actions in Sal Creek (Prussian 2008). The Tier III survey provides additional detail over the Tier II survey, such as habitat parameters subdivided into more detailed levels for collection of additional data on riparian habitat. In addition, channel morphology measurements are replicated and fish populations assessed. The additional outputs may be used to develop or refine RHMOs. These surveys may be appropriate for evaluation of fish enhancement proposals, determination of restoration needs, or studies of habitat utilization by fish (USDA Forest Service 2001a). Although no significant findings were determined from monitoring, general trends indicated an increase in pool frequency and area.

PFC and Tier II surveys were conducted in four reaches of the Gravelly Creek subwatershed in 2001 and 2002 (USDA Forest Service unpublished document 2001 and 2002b). One reach was determined to be “functioning-at risk” with a downward trend due to extensive past riparian harvest, unstable banks, aggradation, and road encroachment. This reach received past restoration efforts including LWD addition in 1989 (USDA Forest Service unpublished document 2001). A second reach was determined to be in “properly functioning condition” with an intact riparian buffer to the slope break (USDA Forest Service unpublished document 2001). A third reach was also in “properly functioning condition” and contained LWD, pool-riffle sequences, and adequate riparian vegetation (USDA Forest Service unpublished document 2002b). A fourth reach was determined to be “functioning-at risk” due to a lack of LWD, pool formations, and spawning gravel (USDA Forest Service unpublished document 2002b). Tier II surveys, conducted in 2002, found low LWD and pool density, large substrate size (small to large boulder), and a previously harvested riparian area (USDA Forest Service unpublished document 2002b).

PFC and Tier II surveys were conducted on one reach in the Falls Creek subwatershed in 2001 (USDA Forest Service unpublished document 2001). The surveyed reach was determined to be “not functioning” due to past riparian harvest, constriction created by an existing bridge, lack of riparian vegetation, lack of LWD and pools, and bank instability and erosion. Additional PFC surveyed reaches on Falls Creek were determined to be “properly functioning” (USDA Forest Service 2006d; Beard 2006) and list Falls Creek as a “functioning” subwatershed.

Lake Habitat

Lakes play an important role in the affected subwatersheds. They moderate streamflow by storing water during dry periods, they provide important fish habitat, and they act as sinks for sediment. The Eagle Creek watershed includes Luck Lake, which is comprised of 531 acres. The Luck Lake vicinity has been impacted from sediment deposition associated with headwater landslides and roads to access timber for harvest. The Big Ratz watershed contains the 208 acre Big Lake, plus the smaller Trumpeter and Little Lakes. The North Kasaan Bay Frontage subwatershed includes the 29-acre Power Lake, which drains into Salt Chuck Bay and was used for an old, failing mining operation. The North Thorne River watershed contains numerous lakes that have been impacted by road conditions (USDA Forest Service 2006d). The Tolstoi Bay-Frontal Clarence Strait watershed contains Water Lake, which supplies potable water to the City of Thorne Bay. The Control Lake and Thorne Lake watersheds contain the highest surface area of lakes and ponds (roughly 409 and 518 acres total lakes and ponds surface area, respectively). See Fisheries section in this chapter for more details on lakes in the project area.

Environmental Consequences

Direct, indirect, and cumulative effects for all affected watersheds are estimated using quantifiable surrogates for actual effects, as supported by the literature cited (for example, stream crossings are a surrogate for increased sediment). The level (magnitude and intensity) of effects is also characterized by descriptors which account for how measurable the effect would be, how widespread the effect is likely to be, and how long it is likely to last. Descriptors of effects are the following:

- Negligible: Effects would be undetectable or if detected, would be considered slight, detectable only at the site, and last less than a day.

- Minor: Effects would be measurable, although the changes would be small, localized to the site or affected stream reach, and last less than a week.
- Moderate: Effects would be measurable at the stream reach or subwatershed scale, and last more than a week.
- Major: Effects would be readily measurable at the watershed scale and would last for years.

Exceptions to these descriptors are noted as applicable, since they are not a perfect fit for all effects. For example, the use of the term "moderate effects" when applied to water quality does not imply water quality degradation. All water quality effects are presumed to be temporary and localized and would not impair or degrade existing or beneficial uses. In the event that subwatersheds or watersheds (or alternatives) are described as having moderate water quality effects, this means that water quality effects associated with roads or other disturbances would be individually temporary and localized, but cumulatively could be occurring at many more sites or over a longer period within the project area. All alternatives would comply with state water quality standards by applying state-approved BMPs along with a monitoring and feedback process. No alternatives would result in long-term water quality degradation or impairment of existing or beneficial uses such as fish habitat. Our ability to actually detect significant changes in streamflow, sediment, habitat features, or other aquatic parameters in response to the Big Thorne Project is extremely limited due to the lack of baseline data and the natural range of variability of these parameters in response to climate and other factors. Nonetheless, we have sufficient information for these watersheds and subwatersheds to proceed with a credible comparison of the magnitude and extent of likely effects across alternatives.

Streamflow

As described in the Affected Environment section, changes in streamflow following timber harvest and road building are commensurate with the proportion of watershed harvested (Harr 1986; Jones and Grant 1996; Jones 2000; Moore and Wondzell 2005). Studies from coastal British Columbia suggest that even selective harvesting may result in statistically significant increases in peak flows (Hudson 2001). Bosch and Hewlett (1982) suggested a threshold effect at 20 percent of basin area harvested. As the forest canopy begins to close, forest canopy recovery is assumed to occur in 30 years (Hicks et al. 1991; Jones 2000) and likely recovery of pre-harvest streamflow conditions. Increases in low flow are also described in a few studies, but are less probable in the affected subwatersheds.

To determine the amount of timber harvested proposed under each alternative, the area harvested was calculated by taking into account actual harvest from the various harvest prescriptions. Even-aged management stands were calculated as 100 percent of the harvest area, and uneven-aged management (also referred to as partial harvest) was calculated as 50, 40, and 25 percent of the harvest area depending on the specific prescription for the harvest unit. In addition, the actual harvest acreages for thinning treatments were taken into account with harvest amount calculations depending on the individual unit prescription. This approach provides an estimate of actual ground clearing and harvest removal acreages necessary for comparing against the streamflow effects threshold of 20 percent of basin area harvested. For analysis purposes, commercial thinning treatments were treated the same as partial harvest.

No shoreline or riparian harvest is proposed under this project. Riparian buffers are designed to mitigate sediment and flow impacts due to harvest. While commercial thinning is proposed for stand improvement in some alternatives, this would take place outside the designated riparian management areas. Non-project PCT would continue where determined needed by Forest Service staff and would be covered under subsequent assessments.

Table WTR-6 displays subwatersheds that will have 20 percent or more area harvested (includes harvest and road area) in the past 30 years, by alternative. These subwatersheds may experience increased peak flow. Road effects on streamflow are accounted for by including road area cleared for each alternative. Further discussion on road effects is included in the sediment and turbidity section below.

Table WTR-6. Proposed Harvest (including road clearing) by Big Thorne Project Alternatives in Affected Subwatersheds

Subwatershed Name	Total Basin Size (Acres)	Harvest and Roads Since 1981 (Percent Basin Area)[1/]				
		Existing Condition (Alt. 1)	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Baird Peak	4,230	0.5	0.8	2.7	0.5	2.1
Barren	2,000	6.8	18.8	18.8	11.2	12.0
Big Ratz	10,299	10.2	13.3	15.2	13.4	14.2
Central Thorne River	6,986	10.8	17.0	17.0	13.7	16.1
Cobble Creek	2,137	9.5	12.1	12.6	11.2	12.5
Control Lake	18,624	3.9	4.3	4.3	4.0	4.2
Deer Creek	2,902	9.3	16.5	18.6	16.2	18.2
Doughnut	1,863	0.0	0.0	0.5	0.0	0.0
Eagle Creek/Slide Creek	4,556	7.5	7.9	8.2	8.2	7.8
East Fork North Thorne River	7,548	6.3	7.1	9.5	7.7	7.9
Falls Creek	2,408	9.4	13.3	13.5	12.3	13.4
Goose Creek	13,502	14.6	18.5	19.0	17.2	17.8
Gravelly Creek	6,864	9.7	10.6	13.0	12.2	12.3
Lake Ellen	5,331	18.2	18.2	18.2	18.2	18.2
Little Ratz Creek	3,530	7.0	9.0	10.7	8.7	9.4
Luck Lake	7,499	14.3	16.8	19.9	16.6	17.3
Luck Point	1,410	11.2	11.2	13.2	11.2	11.2
No Name	1,556	14.3	17.3	19.1	15.5	17.3
North	2,031	6.3	6.7	8.4	7.0	7.0
North Big Salt Lake	20,299	21.3	24.7	25.2	23.3	23.9
North Kasaan Bay Frontage	14,707	28.0	28.1	28.1	28.1	28.1
North Sal	688	8.4	8.4	20.3	8.4	8.4
Pin	857	9.3	9.3	14.1	9.3	9.3
Ratz Harbor	828	5.6	10.2	10.9	6.7	10.8
Rio Beaver Creek	9,050	7.1	9.4	10.7	9.3	10.0
Sal Creek	4,644	8.7	10.6	12.3	11.4	11.6
Salamander	1,289	6.2	6.2	11.0	6.2	6.2
Slide Creek	6,485	10.1	11.4	11.5	10.1	11.1
Snakey Lakes Lowlands	6,645	13.6	19.1	19.4	15.7	17.4
Thorne	2,509	4.3	4.3	11.6	4.3	4.3
Thorne Bay	6,358	18.4	18.5	18.8	18.8	18.8
Thorne Lake	16,110	2.5	2.5	3.6	2.5	2.5
Thorne River Intertidal	1,810	6.1	6.1	8.4	7.5	8.2
Tiny	529	5.8	14.3	15.8	15.8	15.7
Torrent	1,807	9.9	14.6	14.6	13.1	14.1
West Fork Luck Creek	7,317	9.1	11.7	12.1	10.9	11.3
West Fork North Thorne River	8,382	5.6	7.6	8.0	6.5	6.4

1/ Harvest and roads since 1981 includes the existing conditions and conditions after completion of alternative actions. Refer to Watershed Resource Report (James 2013) for calculations

Effects on streamflow in the North Big Salt Lake (all alternatives), North Kasaan Bay Frontage (all alternatives), and North Sal (Alternative 3) subwatersheds could be moderate; but it is unlikely that streamflow increases would be measurable. The Big Thorne Project alternatives are unlikely to increase peak flows in any of the other subwatersheds.

As described in the Analyzing Effects section above, additional harvest of NEPA-cleared units and state lands is planned in watersheds and subwatersheds that would be affected by the Big Thorne Project. These harvest activities could result in additional cumulative streamflow increases (based on percent basin area harvested) in the affected watersheds and subwatersheds. The cumulative effects analysis of the additional harvest combined with harvest proposed under each alternative for each subwatershed is provided in Table WTR-9 and Appendix A of the Watershed Resource Report.

Additional harvest of NEPA-cleared units and state lands in the affected subwatersheds, excluding any project-related harvest, would likely result in additional cumulative streamflow increases (based on percent basin area harvested) in the North Big Salt Lake, North Kasaan Bay Frontage, Pin, and Thorne Bay subwatersheds. Cumulatively, the percent basin area harvested in the past 30 years, plus future harvest of NEPA-cleared units and proposed harvest on state lands in the affected subwatersheds, added to the percent basin area harvested due to the Big Thorne Project alternatives, may result in minor to moderate streamflow increases in the Deer Creek (Alternative 3), and Luck Lake (Alternative 3), and moderate streamflow increases in the North Big Salt Lake (all alternatives), North Kasaan Bay Frontage (all alternatives), North Sal (Alternative 3), Pin (Alternative 3), and Thorne Bay (all alternatives) subwatersheds. The cumulative harvest in the past 30 years in these basins could increase to as much as 20.0, 20.0, 25.6, 28.1, 20.3, 37.3, and 21.7 percent of the basin area, respectively, under Alternative 3 (Table WTR-9 and Appendix A of the Watershed Resource Report, James 2013).

Although cumulative harvest may result in moderate streamflow increases, this assumes harvest of NEPA-cleared units, proposed state lands, and Big Thorne Project alternatives would occur in the same year. This assumption is not correct because this harvest is likely to occur over many years (the Big Thorne Project may occur over 10 years). Because of this timeframe, subwatershed canopy cover in mid-aged harvest areas (those near 30 years since last harvest) would approach normal canopy cover, reducing effects on streamflow. Total cumulative harvest (without Big Thorne harvest) would be less than 20 percent of the basin area by 2015 in all subwatersheds, except the North Kasaan Bay Frontage, Pin, and Thorne Bay subwatersheds, which would not be less than 20 percent of the basin area until 2024, 2041, and 2017, respectively. Therefore, it is unlikely that streamflow increases associated with cumulative harvest would be measurable in any subwatersheds except possibly the North Kasaan Bay Frontage, Pin, and Thorne Bay subwatersheds.

Designating upper acreage amounts that could be harvested during specific years of the 10-year timber sale in subwatersheds expected to have 20 percent or more area harvested over the most recent 30 year-period, may limit increased peak flows. Because the Deer Creek, Luck Lake, North Big Salt Lake, North Kasaan Bay Frontage, North Sal, Pin, and Thorne Bay subwatersheds would all have 20 percent or more area harvested in one or more alternatives if the project and additional planned sales (non-project Forest Service and State sales) occurred, delaying harvest in each subwatershed was considered to determine when total harvest would exceed or drop below the 20 percent level.

The Deer Creek subwatershed would increase to as much as 20.0 percent harvested during the past 30 years, if Alternative 3 and additional planned sales occurred in 2013. If upper acreage amounts that could be harvested between 2013 and 2017 were designated, the Deer Creek subwatershed could be maintained below the 20 percent area harvested within the past 30 years' threshold. However, while the increase associated with Alternative 3 and additional planned sales is at the 20 percent harvest level, the percent harvested would never exceed 20 percent, so no harvest would need to be delayed in the Deer Creek subwatershed.

The Luck Lake subwatershed would increase to as much as 20 percent harvested during the past 30 years if Alternative 3 and additional planned sales occurred in 2013. If upper acreage amounts that could be harvested within 2013 and 2018 were designated, the Luck Lake subwatershed could be maintained below the 20 percent area harvested within the 30 years' threshold. However, while the increase associated with Alternative 3 and additional planned sales is at the 20 percent harvest level, the percent harvested would never exceed 20 percent, so no harvest would need to be delayed in the Luck Lake subwatershed.

The North Big Salt Lake subwatershed would increase to 21.6 percent of forest less than 30 years old under Alternative 1 (no action) if all additional planned sales occurred in 2013. With the action alternatives, this percentage would range from 23.7 under Alternative 4 to 25.6 under Alternative 3. Delaying harvest in the North Big Salt Lake subwatershed would reduce the percent harvested to less than 20 percent and minimize the potential for increased peak flows.

The North Kasaan Bay Frontage subwatershed would increase to as much as 28 percent of forest stands less than 30 years old because of planned future state timber sales under Alternative 1 (no action). The Big Thorne Project harvest would result in no more than a 0.1 percent increase in this percentage under any alternative, and delaying harvest would not substantially reduce the percent area harvested less than 30 years old nor reduce it below the 20 percent level during the expected timeline for the project.

The North Sal subwatershed would increase to as much as 20.3 percent harvested during the past 30 years if Alternative 3 and additional planned sales occurred in 2013. If upper acreage amounts that could be harvested within 2013 and 2021 were harvested, the North Sal subwatershed could be maintained below the 20 percent area harvested within the past 30 years' threshold. Delaying harvest in the North Sal subwatershed would reduce the percent harvested to less than 20 percent and minimize the potential for increased peak flows.

The Pin subwatershed would increase to 32.5 percent of forest less than 30 years old under Alternative 1 (no action), because of planned future state sales. Because of these additional planned sales, delaying harvest could not reduce the percent area harvested to anywhere close to the 20 percent level during the expected timeline for the Big Thorne Project. Only Alternative 3 includes harvest under the Big Thorne Project in the Pin subwatershed.

The Thorne Bay subwatershed would increase to as much as 21.3 percent of forest less than 30 years old because of planned future state timber sales under Alternative 1 (no action). The Big Thorne harvest would result in no more than a 0.4 percent increase in this percentage under any alternative, and delaying harvest would not substantially reduce the percent area harvested less than 30 years old nor reduce it below the 20 percent level during the expected timeline for the project.

At the watershed scale, the Slide Creek – Frontal Clarence Strait watershed does not exceed the 20 percent area harvested since 1981 threshold, even when combined with additional harvest of NEPA-cleared units and state lands. However, effects on streamflow in the North Big Salt Lake (all alternatives), and Tolstoi Bay – Frontal Clarence Strait (Alternative 3) watersheds could be moderate; but it is unlikely that streamflow increases would be measurable. The Big Thorne Project alternatives are unlikely to increase peak flows in any of the other watersheds. The Watershed Resource Report (James 2013) discusses all watersheds in more detail.

Water Quality

Beneficial Uses of Waters in the Project Area

As described in the Affected Environment section, there are two potable water supplies (PWS) in the affected watersheds and subwatersheds: Water Lake and Linkum Creek. The Affected Environment section described the current conditions (Alternative 1) related to the PWS. Neither water supply would be affected by the Big Thorne Project as no activities are proposed in these drainages.

Water Lake is located within the Thorne subwatershed, approximately 0.1 mile north of the municipality of Thorne Bay, and supplies potable water to the area residents. Only Alternative 3 proposes harvesting in the Thorne subwatershed. The proposed units and access roads are located outside of the drainage area of Water Lake. Due to the distance of the PWS from project activity, there would be no impact to Water Lake.

Linkum Creek is located within the North Kasaan Bay Frontage subwatershed near the organized village of Kasaan and supplies water to area residents. Alternatives 2 through 5 propose harvesting in one unit within the North Kasaan Bay Frontage subwatershed. The proposed unit is well outside of the drainage area of Linkum Creek, approximately 8.5 miles away. Due to the distance of the PWS from the proposed unit there will be no impact to Linkum Creek.

Impaired Waterbodies

The Affected Environment section described the current impaired waterbodies in the Big Thorne project area. The impaired waterbodies, Thorne Bay and Salt Chuck Bay, are adjacent to and receive flow from watersheds and subwatersheds within the project area (see Figures WRT-1 and WRT-2).

For the Big Thorne Project, the Thorne Bay MAF is likely to be used for log transport. Within Thorne Bay, approximately 7 acres are designated as impaired due to excessive bark accumulation from log storage and hauling. Water quality has improved and bark accumulation has now decreased in Thorne Bay. If the Thorne Bay MAF is used for the project, it will be a barge-only site. Using this facility as a barge-only site and following site-specific BMPs should result in minimal bark addition to this waterbody, resulting in limited impacts to the impaired waterbody. All permits for this MAF are currently up-to-date for log transfer and barging operations that would be associated with its use for the project.

As part of Alternative 3, harvest activities would include a single unit located approximately 1 mile away from the Salt Chuck mine remediation site and in an adjacent drainage that could potentially be hydrologically connected through roads with surface flow draining into Power Lake, which outflows into Salt Chuck Bay. However, due to the combination of the distance of the harvest unit from the remediation site, the presence of Power Lake intercepting flows and sediment before they reach the site, and the implementation of site-specific BMPs, the likelihood of any increased flows or sediment affecting areas adjacent to the impaired waterbody would result in minimal, if any, impacts. Therefore, it is highly unlikely that the project would result in further degradation of the listed waterbody or hamper further remediation efforts.

Contaminated Sites

The Affected Environment section described the four contaminated sites in subwatersheds within the project area that are open: the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill. The Forest Service Thorne Bay Warehouse Historic Spills and Thorne Bay DuRette Shop sites are located within the town of Thorne Bay. As no ground disturbance activities for any alternative occurs within the town of Thorne Bay, these locations would not be affected by project activities.

As stated above, there is potential for hydrologic connection between proposed harvest (under Alternative 3) in an adjacent watershed and the Forest Service Salt Chuck Mine site. Within the upland areas of the Salt Chuck Mine site, remediation activities for the Forest Service land are complete. The remaining remediation activities are the responsibility of the State and EPA and could include marine remediation and additional stream work. The old Power Lake dams associated with the mine are decaying and may be removed or fail, resulting in sediment discharge from the lake and downstream channel changes outside of the project area in the Lake Ellen and North Kasaan Bay Frontage subwatersheds (references in Big Thorne Project Record). Any increases in sediment and/or flows from project activities are unlikely to reach the Salt Chuck Mine site due to the same factors stated above (in Impaired Waterbodies). Therefore, it is unlikely that the project would result in further impacts to the contaminated site or hamper further remediation efforts.

The Forest Service Thorne Bay Landfill is within the Torrent subwatershed. As part of Alternatives 2, 3, and 5, project activities would include harvest in two units (approximately 6 acres each) that would be hydrologically connected to the Forest Service Thorne Bay Landfill. The two harvest units are located outside of the Forest Service Landfill, approximately 0.1 and 0.5 mile, in the headwaters of South Creek and Ditch Creek, respectively. Neither stream is fish-bearing within the harvest units; however both are fish-bearing streams through the landfill. The harvest unit located approximately 0.1 mile from the landfill proposes harvest on both sides of South Creek. This headwater portion of South Creek is Class III and has the potential to transport sediment to the fish-bearing portion of the creek running through the middle of the landfill. Harvest actions could contribute to increased streamflow and sedimentation within

South Creek; however, implementation of the riparian no-harvest Class III stream buffer and BMPs (as described on the unit cards) would minimize increased streamflow and sedimentation in the creek and not likely have an effect on iron or manganese concentrations in the landfill. The harvest unit located approximately 0.5 mile from the landfill proposes harvest adjacent to Ditch Creek. This headwater portion of Ditch Creek is Class IV. Because this portion of Ditch Creek is Class IV, and due to implementation of BMPs, project actions are not likely to have an effect on iron or manganese concentrations in the landfill.

Acid Rock Drainage

As discussed in the Affected Environment section, ARD has occurred north of the Big Thorne project area along the Forest Road 3030 (Coffman Cove Road). During road construction, the use of pyritic material from the Descon Formation resulted in the generation of ARD. This formation has been identified within the Big Thorne project area. Existing forest roads and quarries in the Big Thorne project area are constructed from the Descon Formation. It is estimated that 253.8 miles of existing road, likely constructed from the Descon Shale, exists within the Big Thorne project area. It is not known if the material sources used in this construction contained mineralization. However, no past problems have been observed (Baichtal personal comm. 2011, as cited in Barnhart and Hitner 2013b). Present or reasonably foreseeable actions or new construction on these road or use of quarries from this rock formation would be tested for sources with high potential and be avoided. If ARD potential rock is disturbed, mitigation would include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Road construction and quarry development for the Big Thorne Project activities would utilize and excavate into the underlying Descon Shale. Any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas would be assessed for its ARD potential (Baichtal personal comm. 2011, as cited in Barnhart and Hitner 2013b). In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist would provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials would be tested and sources with high potential would be avoided. If ARD potential rock is disturbed, mitigation would include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction. Ongoing monitoring of streams at the Forest Service Road 3030 site where this has been implemented suggests gradual improvement and return to more natural water quality conditions in the local streams following this and other actions (Wilcox personal comm. 2013; AMEC 2010, 2011, 2012). See Existing Conditions section for details.

Sediment and Turbidity

Road ditches integrate with and extend the stream network, thereby increasing sediment transport efficiency to streams (Montgomery 1994; Wemple et al. 1996). Road effects on streamflow, sediment, and turbidity may not recover until flow paths are reclaimed during road decommissioning. Roads can modify drainage density by extending the stream channel network by linking roads to stream channels through hydrologic flow paths. This frequently happens when roadside ditches collect hill-slope non-stream surface and subsurface flows and drain them directly into a stream, or reroute headwater streams into a roadside ditch for a distance before draining them into a different stream system.

In the Big Thorne project area, the existing extent of roads in some affected watersheds, combined with the knowledge that some roads, such as those found in the Eagle and North Thorne River watersheds, have failed drainage structures and ditch or road surface erosion, suggests that additional road construction activities would compound the effects of extended stream networks until progress is made on road storage and decommissioning. Where poor maintenance is responsible for added drainage network effects, proper maintenance may help reduce sedimentation from the road network. The Watershed Resource Report (James 2013) describes specific areas and roads of concern for some watersheds and specific issues with roads used for the project are presented in the Road Cards.

Watershed Inventory Tracking (WIT) surveys were conducted in units within the project area, primarily on existing stored roads that were not drivable. Based on these surveys, the lack of road maintenance presents chronic sediment sources at 145 sites on 30 miles of surveyed roads. Most of these sites are in the Rio Beaver Creek (29), Deer Creek (27), Luck Lake (17), and West Fork Thorne River (17) subwatersheds. At the watershed scale, North Thorne River (31) and Rio Beaver Creek (29) have the highest number of sites for the surveyed roads planned for reconstruction. It is the intent that the reconstructed roads for the Big Thorne Project will be brought up to Forest Plan Standards. This will be accomplished by stabilizing slopes, replacing undersized and degraded culverts, clearing blocked culverts, installing drainage culverts, clearing and reestablishing road ditches, re-contouring road prisms, revegetating bare soils, and realigning streams to appropriate road crossings.

Road reconstruction of Management Level (ML) 1 stored roads would likely have less of an effect on streamflow and sediment production than new construction, as disturbance to the existing landscape would be less. Reconstruction activities would include brushing, clearing of alders and replacing drainage structures. Reconstruction would keep the roads in a safe and useful condition for which they are managed, while meeting Forest Plan standards and guidelines and following the applicable BMPs (see Road Management Objective [RMO] road cards for road site-specific items). No changes are being proposed to the Objective Maintenance Level (OBML) and RMOs designated in the Prince of Wales ATM (Barnhart and Hitner 2013b).

Alternatives 2 through 5 would include standard maintenance of existing roads and timber purchaser would be required to maintain roads to meet BMPs (Barnhart and Hitner 2013b). Impacts would be moderated by the requirement that all new, reconstructed ML1 stored, and new road construction over decommissioned road grades would either be stored or decommissioned after timber harvest. Specifically, all temporary roads would be decommissioned after timber harvest. All new system roads (new roads and new road construction over decommissioned road grades) and reconstructed ML1 stored roads would remain seasonally open for firewood gathering for up to 5 years after timber harvest, with seasonal closures between November 30 and May 1. Seasonal closure reduces use, thereby reducing sediment impacts associated with use. In addition, closing roads during the wetter months reduces the potential for rutting and road degradation occurring due to travel on saturated road surfaces. At the end of 1 to 5 years, all new system roads and reconstructed ML1 stored roads would be designated as not for public motor vehicle use and would be placed in a self-maintaining hydrologic status. These roads would be reviewed annually and would be intermittent service roads (ML1) after the completion of timber sale and additional activities and physically blocked or natural vegetation allowed to grow and eliminate motorized access. Other than red culverts that would be removed or replaced, drainage structures would be reviewed on a case-by-case basis and may be removed or left in place with additional cross drains. A review will be conducted at the time of closure for any additional resource concerns needing to be addressed (Barnhart and Hitner 2013b).

The one exception to road storage designation is that 0.1 to 2.8 miles of road, depending on the selected alternative, would be maintained for OHV use. The roads designated for this use would not cross any fish-bearing streams. Considering the limited road bed disturbance caused by OHVs, limited frequency of use by OHVs, and lack of stream channel disturbance from this use, this exception would not result in effects to sedimentation of aquatic systems.

Lack of road maintenance presents a chronic sediment problem in the Big Thorne project area (USDA Forest Service unpublished document 2002a; Fryxell 2010; Beard 2011). The Affected Environment section discusses some known areas of road sediment issues within the project area. The effects of road-related sediment sources at the watershed scale probably cannot be measured; however, historic road building and maintenance practices represent a chronic source of sediment and do not meet road management objectives (USDA Forest Service unpublished document 2002a; Fryxell 2010; Beard 2011).

All road construction for the Big Thorne Project would follow the applicable BMPs and all temporary roads would be decommissioned after harvest. New and reconstructed system roads would be closed and placed in storage within 1 to 5 years as described in the road cards (Appendix C of the Draft EIS; also see Barnhart and Hitner 2013 and James 2013 for different levels of storage and impacts). Decommissioning of temporary roads and storage of any new and reconstructed system roads would reduce sedimentation effects of road construction. While all new road construction would follow BMPs and Forest Plan Standards and Guidelines, there may be increased risk of sedimentation due to the presence of the road prism within subwatersheds, which contributes to the cumulative road area within the subwatersheds.

Under existing conditions (Alternative 1) the Deer Creek, Ratz Harbor, Salamander, Slide Creek, Thorne River Intertidal, and Torrent subwatersheds exceed the analytical threshold (Cederholm et al. 1980) of 2.5 percent basin area in roads (Table WTR-7). As a result of proposed new road miles, ML1 stored road miles, and construction over decommissioned road miles, the Deer Creek (Alternatives 2 through 5), Pin (Alternative 3), Ratz Harbor (Alternatives 2 through 4), Salamander (Alternative 3), Slide Creek (Alternatives 2 through 4), Thorne River Intertidal (Alternatives 3), and Torrent (Alternatives 2 through 5) subwatersheds would exceed the analytical threshold for the indicated alternatives that have additional alternative specific road construction. Although none of these subwatersheds are above the 20 percent harvest and roads since 1981 (Table WTR-6) under any of the alternatives, because the analytical threshold of 2.5 percent basin in roads is exceeded, fine sediment accumulation in streams would be a concern. Although a statistical relationship between fine sediment in streams and watershed disturbance has not been reported in Southeast Alaska studies (Bryant et al. 2004; Woodsmith et al. 2005), according to the analytical threshold selected for this project, road construction and reconstruction in these subwatersheds could have moderate effects on water quality compared to other subwatersheds in the project area. These effects are not expected to degrade water quality or fish habitat.

Table WTR-7. Proposed Road Construction by Big Thorne Project Alternatives

Subwatershed Name	Total Basin Size (Acres)	Existing Roads (Alternative 1)		Alternative 2 Roads		Alternative 3 Roads		Alternative 4 Roads		Alternative 5 Roads	
		Total Existing Roads (miles)[1/]	Percent of Basin as Roads[1/2/]	Total Project Road miles[3/]	Percent of Basin as Roads	Total Project Road miles[3/]	Percent of Basin as Roads	Total Project Road miles[3/]	Percent of Basin as Roads	Total Project Road miles[3/]	Percent of Basin as Roads
Baird Peak	4,230	2.0	0.2	1.6	0.3	2.2	0.3	0.0	0.2	1.8	0.2
Barren	2,000	7.5	1.8	3.3	2.5	3.3	2.5	0	1.8	0.0	1.8
Big Ratz	10,299	29.0	1.4	2.5	1.4	5.6	1.4	3.3	1.4	1.7	1.4
Central Thorne River	6,986	19.9	1.4	4.3	1.6	4.3	1.6	1.1	1.4	2.2	1.5
Cobble Creek	2,137	7.7	1.8	0.6	1.9	0.9	1.9	0.2	1.8	0.2	1.8
Control Lake	18,624	22.7	0.6	1.1	0.6	1.1	0.6	0.3	0.6	1.1	0.6
Deer Creek	2,902	19.0	3.2	5.4	3.5	8.2	3.5	4.2	3.2	1.9	3.2
Doughnut	1,863	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eagle Creek/Slide Creek	4,556	12.5	1.3	0.0	1.3	1.0	1.3	1.0	1.3	1.0	1.3
East Fork North Thorne	7,548	14.3	0.9	0.4	0.9	0.6	0.9	0.1	0.9	0.1	0.9
Falls Creek	2,408	9.0	1.8	0.8	2.0	1.2	2.0	0.6	1.8	1.0	1.9
Goose Creek	13,502	34.9	1.3	4.7	1.4	5.1	1.4	0.1	1.3	1.2	1.3
Gravelly Creek	6,864	28.5	2.0	0.7	2.0	7.3	2.1	3.4	2.0	5.2	2.1
Lake Ellen	5,331	23.6	2.1	0.0	2.1	0.1	2.2	0.0	2.1	0.0	2.1
Little Ratz Creek	3,530	9.7	1.3	0.0	1.3	2.6	1.3	2.4	1.3	0.0	1.3
Luck Lake	7,499	25.7	1.7	2.3	1.7	5.5	1.8	2.6	1.7	3.4	1.7
Luck Point	1,410	3.4	1.2	0.0	1.2	0.6	1.3	0.0	1.2	0.0	1.2
No Name	1,556	5.7	1.8	0.3	1.9	0.5	1.9	0.0	1.8	0.0	1.8
North	2,031	6.5	1.6	0.3	1.6	0.7	1.6	0.4	1.6	0.5	1.6
North Big Salt Lake	20,299	59.0	1.4	4.7	1.5	6.9	1.5	1.7	1.4	2.0	1.4
North Kasaan Bay Frontage	14,707	56.3	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0	1.9
North Sal	688	2.0	1.4	0.0	1.4	0.1	1.4	0.0	1.4	0.0	1.4
Pin	857	3.8	2.1	0.0	2.1	1.3	2.9	0.0	2.1	0.0	2.1
Ratz Harbor	828	4.5	2.6	0.9	3.0	1.1	3.0	0.2	2.6	0.0	2.6
Rio Beaver Creek	9,050	31.0	1.7	4.0	1.7	8.3	1.7	4.2	1.7	4.8	1.7
Sal Creek	4,644	14.0	1.5	0.9	1.5	1.1	1.5	0.5	1.5	0.0	1.5
Salamander	1,289	7.6	2.9	0.0	2.9	0.5	3.1	0.0	2.9	0.0	2.9
Slide Creek	6,485	37.1	2.8	2.9	2.9	3.4	2.9	1.5	2.8	0.0	2.8
Snakey Lakes Lowlands	6,645	14.3	1.0	4.8	1.2	5.4	1.2	2.5	1.1	2.8	1.1
Thorne	2,509	1.8	0.3	0.0	0.3	3.1	1.0	0.0	0.3	0.0	0.3
Thorne Bay	6,358	31.2	2.4	0.1	2.4	0.3	2.4	0.3	2.4	0.3	2.4
Thorne Lake	16,110	7.7	0.2	0.0	0.2	2.5	0.3	0.0	0.2	0.0	0.2
Thorne River Intertidal	1,810	9.4	2.5	0.0	2.5	0.9	2.6	0.4	2.5	0.4	2.5
Tiny	529	2.2	2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0
Torrent	1,807	16.8	4.5	0.8	4.7	0.8	4.7	0.2	4.5	0.2	4.5
West Fork Luck Creek	7,317	18.2	1.2	0.0	1.2	0.0	1.2	0.0	1.2	0.0	1.2
West Fork North Thorne	8,382	11.7	0.7	3.0	0.7	3.0	0.7	0.5	0.7	0.0	0.7
Total		**610.3**		**50.2**		**88.1**		**30.8**		**34.1**	

1/ Percent basin in road was calculated by converting miles of road to acres of road using an estimated 40 feet road width and then calculating the percent of basin acres in road acreage.
2/ Table includes all roads in available GIS coverage's [system (including roads in storage), temporary (including any decommissioned roads still available in the GIS layers), unauthorized, and non-National Forest roads].
3/ Total Project Road Miles (system and temporary roads) include proposed new roads, new construction over decommissioned road grades, and reconstructed ML1 roads. Only proposed new roads affect the percent basin in roads as the other two categories are accounted for in the existing conditions. Differences in amount of total miles per alternative compared to the Transportation report are due to rounding.
4/ Differences in total miles versus summation of reported values in columns are due to rounding.

Due to cumulative road miles associated with existing conditions, NEPA-cleared unharvested units, and harvest on state lands (Appendix B of the Watershed Resource Report [James 2013])), the Deer Creek, Pin, Ratz Harbor, Salamander, Slide Creek, Thorne Bay, Thorne River Intertidal, and Torrent subwatersheds exceed the analytical threshold of 2.5 percent basin area in roads. When proposed new road miles are combined with road miles associated with existing conditions, NEPA-cleared unharvested units, and harvest on state lands, the Deer Creek (Alternatives 2 through 5), Pin (Alternative 3), Ratz Harbor (Alternatives 2 through 4), Salamander (Alternative 3), Slide Creek (Alternatives 2 through 4), Thorne Bay (Alternatives 2 through 5), Thorne River Intertidal (Alternatives 3 through 5), and Torrent (Alternatives 2 through 5) subwatersheds would further exceed the analytical threshold for the indicated alternatives. Furthermore, the Sal Creek and Slide Creek subwatersheds have areas of known sediment sources related to roads (Thompson and Brigham personal comm. 2012), and the Deer Creek, Big Ratz, No Name, and Slide Creek subwatersheds have the highest risk for sediment impacts out of 17 subwatersheds evaluated (Prussian and Bair 2006). In addition, within the Big Ratz, Deer Creek, and Slide Creek subwatersheds, factors such as unstable soils and landslides contribute sediment, and further land-disturbing activities may increase sediment delivery potential. The effects of fine sediment accumulation in streams within these subwatersheds could be moderate; but it is unlikely that sediment accumulation would be measurable. Decommissioning all Big Thorne Project temporary roads and applying BMPs, described in the unit cards, would minimize impacts to water quality. Storage of new and reconstructed system roads would also occur. However, there would be potential for sedimentation inherent to road presence in the subwatersheds. Alternatives with higher road construction would have higher sedimentation potential due to the presence of the road prism within subwatersheds.

Restoration efforts to remediate some of the existing chronic sediment issues include actions related to the Luck Lake Area Watershed Restoration Plan (Fryxell 2010). These include planned road maintenance, riparian management and large woody debris (LWD) placement. Floodplain streams in this watershed are dependent upon wood for sediment retention and bank stabilization (Fryxell 2009). Past management actions have resulted in low functional wood within these streams. Wood placement can aid in maintaining channel morphology, sediment deposition, and preventing rapid loss of alluvial sediments and eroding banks (Fryxell 2009, 2010). Planned restoration efforts include LWD placement and road decommissioning and improvement to 2.5 miles of stream in the lower East Fork and Middle Forks of Luck Creek, and in the West Fork and main stem of Luck Creek. The LWD material will be obtained from along old logging roads in the project area that are slated for closure. Upon completion of the restoration actions, natural drainage patterns and fish access will be restored along the road segments in accordance with the Prince of Wales ATM (USDA Forest Service 2009a).

At the watershed scale, the Slide Creek – Frontal Clarence Strait watershed does not exceed the 2.5 percent threshold, even when combined with cumulative road miles associated with existing conditions, harvest on state lands, and Big Thorne Project activities. However, the Thorne Bay – Frontal Tolstoi Bay watershed exceeds the 2.5 percent basin area in roads threshold under all alternatives, including existing conditions. The effects of fine sediment accumulation in streams within this watershed could be moderate; but it is unlikely that sediment accumulation would be measurable. Decommissioning all Big Thorne project area temporary roads and following BMPs, described in unit cards, would limit roadway-induced sediment runoff to streams. Storing new and reconstructed system roads may provide additional watershed benefits. However, while all new road construction will follow BMPs and Forest Plan Standards and Guidelines, there may be increased risk of sedimentation due to the presence of the road prism within subwatersheds. The Watershed Resource Report (James 2013) discusses all watersheds in more detail.

Road construction, including bridge and culvert installation, is expected to temporarily increase sediment delivery to streams (Paustian 1987); however, results of grab sample turbidity monitoring during drainage structure installation suggests that under typical construction conditions, BMPs are effective in achieving water quality criteria within a couple of days following completion of instream work (Thompson 2002). In monitoring installation of four new stream structures and one bridge installation within the Tongass National Forest, downstream turbidity following installation did not exceed state water quality standards (USDA Forest Service 2009c). Tucker and Thompson (2010) conducted a comparison study related to management practices that included Shaheen Creek on Prince of Wales Island and concluded that the Forest Plan standards and guidelines are effective in maintaining water quality in Shaheen Creek. Furthermore, Tucker and Thompson (2010) results suggest that increases in turbidity (and sediment) within Shaheen Creek may not be measurable when compared to natural conditions, and if downstream increases were detected in the study, recovery to baseline level occurred without degrading water quality.

Riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, and BMPs, as described in the road cards, would minimize erosion and sediment transport to streams (Rashin et al. 2006) and maintain cool stream temperatures (Gomi et al. 2006). Where Class IV streams are within harvest units, disturbance would be minimized through BMPs described in the unit cards. Tongass National Forest monitoring data indicate that harvested areas are consistently within the established standard of less than 15 percent detrimental soil disturbance (USDA Forest Service 2005a). Recent BMP implementation and effectiveness monitoring of five harvest units and related roads by an interdisciplinary team on Prince of Wales Island found effective implementation of the BMPs and no sign of erosion or sedimentation into site area streams (USDA Forest Service 2011e). These findings suggest that ground disturbance during timber harvest alone is probably not a direct source of sediment. Timber harvest would have negligible direct effects on water quality at both the watershed and subwatershed scale.

In addition to evaluating sediment effects within each subwatershed based on the analytical threshold from Cederholm et al. (1980), the number of proposed road-stream crossings (by stream Classes I, II, and III) was determined for each of the alternatives (Table WTR-8). Because existing road crossings on decommissioned and stored roads are already counted in the existing conditions under Alternative 1 (Table WTR-8), only proposed new crossings would increase the total road-stream crossing count. Table WTR-8 also shows the number of total crossings that could potentially be impacted by project alternatives. These numbers are displayed in parentheses next to the total number (they include crossings along roads to be reconstructed and roads built over decommissioned road grades). For example, in the Deer Creek subwatershed, under Alternative 2, there would be a total of 38 stream crossings, which is only 1 more crossing than under existing conditions. However, when reconstructed road crossings (9) and road crossings on roads built over decommissioned grades (0) are included, in the count of crossings potentially impacted by the project, there are a total of 10 crossings that could have project activities in the Deer Creek subwatershed under Alternative 2.

This page intentionally left blank.

Table WTR-8. Proposed Road-Stream Crossings by Big Thorne Project Alternatives in Affected Watersheds

Subwatershed Name	Existing Road Crossings (Alternative 1)				Crossings by Subwatershed for Action Alternatives[1/]															
					Alternative 2				Alternative 3				Alternative 4				Alternative 5			
	I	II	III	Total	I	II	III	Total[2/]	I	II	III	Total[2/]	I	II	III	Total[2/]	I	II	III	Total[2/]
Baird Peak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barren	6	4	0	10	6	4	0	10	6	4	0	10	6	4	0	10	6	4	0	10
Big Ratz	19	26	24	69	19	26	25	70 (3)	19	26	25	70 (12)	19	26	24	69 (8)	19	26	24	69 (2)
Central Thorne River	14	11	4	29	14	12	4	30 (2)	14	12	4	30 (2)	14	11	4	29	14	11	4	29
Cobble Creek	3	3	12	18	4	3	12	19 (1)	4	3	12	19 (1)	3	3	12	18	3	3	12	18
Control Lake	24	14	11	49	24	14	11	49	24	14	11	49	24	14	11	49	24	14	11	49
Deer Creek	1	27	9	37	1	27	10	38 (10)	1	27	10	38 (16)	1	27	9	37 (9)	1	27	9	37 (6)
Doughnut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eagle Creek/Slide Creek	19	7	11	37	19	7	11	37	19	7	11	37 (1)	19	7	11	37 (1)	19	7	11	37 (1)
East Fork North Thorne	24	9	35	68	25	9	35	69 (1)	26	9	35	70 (2)	24	9	35	68	24	9	35	68
Falls Creek	4	0	9	13	4	0	9	13	4	0	9	13 (2)	4	0	9	13 (2)	4	0	9	13 (2)
Goose Creek	29	10	36	75	30	10	36	76 (1)	30	10	36	76 (1)	29	10	36	75	29	10	36	75
Gravelly Creek	10	20	37	67	10	20	37	67	10	20	38	68 (19)	10	20	37	67 (6)	10	20	37	67 (11)
Lake Ellen	13	5	23	41	13	5	23	41	13	5	23	41	13	5	23	41	13	5	23	41
Little Ratz Creek	7	22	13	42	7	22	13	42	7	22	13	42 (12)	7	22	13	42 (11)	7	22	13	42
Luck Lake	10	22	28	60	10	22	28	60 (3)	10	22	29	61 (6)	10	22	28	60 (3)	10	22	28	60 (4)
Luck Point	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3
No Name	0	12	15	27	0	12	15	27	0	12	15	27	0	12	15	27	0	12	15	27
North	6	9	1	16	6	9	1	16 (1)	6	9	1	16 (2)	6	9	1	16	6	9	1	16 (2)
North Big Salt Lake	18	42	76	136	18	44	82	144 (10)	18	44	82	144 (24)	18	42	77	137 (1)	18	42	77	137 (1)
North Kasaan Bay Frontage	7	10	15	32	7	10	15	32	7	10	15	32	7	10	15	32	7	10	15	32
North Sal	0	0	4	4	0	0	4	4	0	0	4	4	0	0	4	4	0	0	4	4
Pin	1	5	2	8	1	5	2	8	2	7	2	11 (3)	1	5	2	8	1	5	2	8
Ratz Harbor	3	7	0	10	3	7	0	10	3	7	0	10	3	7	0	10	3	7	0	10
Rio Beaver Creek	38	10	36	84	38	10	36	84 (8)	38	10	36	84 (24)	38	10	36	84 (15)	38	10	36	84 (11)
Sal Creek	18	12	12	42	18	12	12	42 (3)	18	12	12	42 (3)	18	12	12	42 (3)	18	12	12	42
Salamander	8	7	3	18	8	7	3	18	8	7	3	18	8	7	3	18	8	7	3	18
Slide Creek	9	23	18	50	9	23	18	50 (3)	9	23	18	50 (5)	9	23	18	50 (3)	9	23	18	50
Snakey Lakes Lowlands	18	3	0	21	18	3	0	21 (4)	18	3	0	21 (4)	18	3	0	21 (2)	18	3	0	21 (2)
Thorne	1	0	1	2	1	0	1	2	2	0	1	3 (1)	1	0	1	2	1	0	1	2
Thorne Bay	20	12	21	53	20	12	21	53	20	12	21	53	20	12	21	53	20	12	21	53
Thorne Lake	2	9	7	18	2	9	7	18	2	12	9	23 (5)	2	9	7	18	2	9	7	18
Thorne River Intertidal	7	2	2	11	7	2	2	11	7	2	2	11	7	2	2	11	7	2	2	11
Tiny	0	2	7	9	0	2	7	9	0	2	7	9	0	2	7	9	0	2	7	9
Torrent	4	11	6	21	4	11	6	21	4	11	6	21	4	11	6	21	4	11	6	21
West Fork Luck Creek	17	10	19	46	17	10	19	46	17	10	19	46	17	10	19	46	17	10	19	46
West Fork North Thorne	4	28	21	53	4	28	21	53 (19)	4	28	21	53 (19)	4	28	21	53 (3)	4	28	21	53
Total – All	**364**	**395**	**520**	**1,279**	**367**	**398**	**528**	**1,293 (69)**	**370**	**403**	**532**	**1,305 (164)**	**364**	**395**	**521**	**1,280 (68)**	**364**	**395**	**521**	**1,280 (42)**
Total Proposed New					3	3	8	14	6	8	12	26	0	0	1	1	0	0	1	1
Total Reconstructed ML1 Road					16	27	8	51	32	62	28	122	24	28	7	59	16	15	8	39
Total Construction Over Decommissioned Road Grade					2	1	1	4	3	6	3	12	2	3	2	7	2	1	1	4

1/ Road-stream crossings are by stream class and are the total number of stream crossings (existing and proposed) that would exist under that alternative.
2/ The total includes existing and proposed new crossings. Reconstructed ML1 road crossings and crossings for new construction over decommissioned road grades are already accounted for in the existing crossing numbers. Parentheses values are total number of crossings with possible project activity (crossings for proposed new roads, reconstructed ML1 roads, and new construction over decommissioned road grades). See Watershed Resource Report (James 2013) for additional information regarding crossing types by subwatershed and watershed.

Alternative 3 proposes the most new road-stream crossings (26 Class I, II, and III streams) as well as the most road-stream crossings for new construction over decommissioned road grades (12 Class I, II, and III streams). High stream crossing numbers indicate typically higher potential for short term (last less than a week) sedimentation due to construction in the stream and long-term (potentially last for years) effects due to drainage disruption by the road prisms. Properly placed and maintained crossings affect only the local channel segment, and are individually minor effects.

The subwatershed with the most road-stream crossings, under all alternatives, is North Big Salt Lake. The subwatersheds with most stream crossings for reconstructed roads includes the Rio Beaver (under all action alternatives) and West Fork North Thorne River (Alternatives 2 and 3) (see Watershed Resource Report [James 2013] for detailed crossing analysis).

At the watershed scale, the Slide Creek – Frontal Clarence Strait watershed has the most existing Class I through III road-stream crossings. The watersheds with the most proposed stream crossings include North Big Salt Lake (Alternatives 2 and 3), Thorne Lake (Alternative 3), and Tolstoi Bay – Frontal Clarence Strait (Alternative 3). The watershed with the most reconstructed stream crossings include in North Thorne River (Alternative 2), Rio Beaver Creek (Alternative 3), Slide Creek – Frontal Clarence Strait (Alternative 4), and Outlet Thorne River (Alternative 5) (see Watershed Resource Report [James 2013] for calculations).

Reconstructed road crossings are likely to have less of an impact than new road crossings; however, sediment impacts are still likely and proper road storage and decommissioning are necessary to minimize sediment impacts. Sedimentation effects resulting from replacement of the stream crossing structures on reconstructed roads should be shorter term and more localized than installation of stream crossings for new road construction, because the road prism, and in some cases bridge abutments, already exist for reconstructed roads. Proper decommissioning and maintenance procedures, and adherence to BMPs, should minimize effects from road construction and stream crossings. Road closure and storage actions for system roads may result in limited road prism and crossing removal. Because of limited road prism and crossing removal, there may continue to be increased risk of sedimentation due to the presence of the road prism within subwatersheds.

Temperature

Riparian no-harvest buffers along Class I, II, and III streams would maintain cool stream temperatures (Gomi et al 2006). No effects to stream temperature are anticipated as a result of implementation of any of the action alternatives.

Stream Habitat

Riparian no-harvest buffers along Class I, II, and III streams, as described in the unit cards, will avoid direct impacts to stream habitat in watersheds and subwatersheds. Effects will be negligible and limited to road-stream crossing corridors. Table WTR-8 provides alternative comparison for numbers of stream crossings at the subwatershed level, including fish streams, for new roads and reconstructed ML1 stored roads. Alternative 3 proposes 14 new road crossings on fish-bearing streams, far more than any other alternative. Additionally, this alternative proposes on ML1 stored roads to reconstruct up to 97 crossings on fish-bearing streams, and 9 crossings on fish-bearing streams for roads proposed over decommissioned roadbeds.

Stream buffers with high wind risk have been identified and will receive consideration for reasonable assurance of windfirm buffer design during unit layout (Barnhart, Hitner, and Iozzi 2013). BMPs for harvest units require the implementation of stream buffers adequate to be reasonably maintained after harvest known as reasonable assurance of windfirmness (RAW) buffers. Recent Forest Plan monitoring results have shown that "post-harvest windthrow is present in 140 (52 percent) of the 266 buffers monitored adjacent to units harvested from 2000 through 2007. The average amount of windthrow in the buffers is 6.5 percent. The amount of windthrow is expressed as the cumulative number of trees windthrown divided by the original number of standing trees in a buffer. The cumulative windthrow mortality in the buffers is highly variable and ranges from 0 to 85 percent. To date, 74 percent of the buffers have less than 5 percent windthrow mortality, 83 percent have less than 10 percent windthrow, and 96 percent of the buffers have less than 50 percent windthrow (USDA Forest Service 2011f).

Lake Habitat

Lake riparian buffers and other BMPs would avoid effects on lake habitat. Effects on lake habitat would be negligible.

Effects by Alternative

Analysis of direct, indirect, and cumulative effects for the Big Thorne Project is provided in the previous sections (see Environmental Consequences section above on Streamflow, Water Quality, Stream Habitat, and Lake Habitat). The following sections provide summaries of direct, indirect, and cumulative effects for each alternative and comparisons among alternatives.

Tables WTR-9 and WTR-10 present summaries of cumulative harvest and cumulative road construction and acres by subwatershed for each alternative. These tables incorporate reasonably foreseeable future projects. Table WTR-11 summarizes the results from analyzing direct, indirect, and cumulative effects by subwatershed.

Table WTR-9. Cumulative Harvest by Big Thorne Project Alternative

Subwatershed Names	Total Basin Size (Acres)	Existing and Foreseeable (Alternative 1): Total Harvested and Roads since 1981 (Acres)[1/]	Existing and Foreseeable (Alternative 1): Reasonably Foreseeable Harvest (Acres)[2/]	Existing and Foreseeable (Alternative 1): Harvest and Roads Since 1981 (% Basin Area)[3/]	Alternative 2: Proposed Harvest and Roads (Acres)[4/]	Alternative 2: Cumulative harvest and Roads Since 1981 (% Basin Area)[5/]	Alternative 3: Proposed Harvest and Roads (Acres)[4/]	Alternative 3: Cumulative harvest and Roads Since 1981 (% Basin Area)[5/]	Alternative 4: Proposed Harvest and Roads (Acres)[4/]	Alternative 4: Cumulative harvest and Roads Since 1981 (% Basin Area)[5/]	Alternative 5: Proposed Harvest and Roads (Acres)[4/]	Alternative 5: Cumulative harvest and Roads Since 1981 (% Basin Area)[5/]
Baird Peak	4,230	19	1	0.5	15.0	0.8	96.0	2.8	0.0	0.5	70.0	2.1
Barren	2,000	124	<1	6.8	253.7	18.8	239.7	18.8	88.0	11.2	105.0	12.1
Big Ratz	10,299	1,017	3	10.2	323.7	13.4	510.2	15.2	328.0	13.4	414.0	14.3
Central Thorne River	6,986	721	2	10.9	429.1	17.0	433	17.1	201.0	13.8	371.6	16.2
Cobble Creek	2,137	199	1	9.5	57.8	12.2	66.8	12.6	38.0	11.3	65.0	12.5
Control Lake	18,624	645	93	4.3	75.9	4.8	75.9	4.8	30.3	4.5	71.9	4.7
Deer Creek	2,902	256	42	10.8	209.7	18.0	269.7	20.0	200.0	17.7	259.0	19.7
Doughnut	1,863	0	1	0.0	0.0	0.0	9.0	0.5	0.0	0.0	0.0	0.0
Eagle Creek/Slide Creek	4,556	338	1	7.5	19.0	8.0	32.0	8.3	31.0	8.2	14.0	7.9
East Fork North Thorne River	7,548	456	2	6.3	59.2	7.1	244.8	9.6	108.0	7.7	122.0	7.9
Falls Creek	2,408	218	1	9.4	95.0	13.4	98.0	13.5	71.0	12.4	98.0	13.5
Goose Creek	13,502	1,890	68	15.1	531.5	19.0	601.5	19.5	352.0	17.7	441.6	18.3
Gravelly Creek	6,864	649	2	9.8	60.1	10.6	227.2	13.1	172.1	12.3	179.1	12.4
Lake Ellen	5,331	953	<1	18.2	0.0	18.2	0.4	18.2	0.0	18.2	0.0	18.2
Little Ratz Creek	3,530	238	1	7.0	71.0	9.0	130.0	10.7	60.0	8.7	86.0	9.5
Luck Lake	7,499	1,038	2	14.3	185.7	16.8	423.5	20.0	174.2	16.6	227.2	17.3
Luck Point	1,410	150	<1	11.2	0.0	11.2	29.0	13.3	0.0	11.2	0.0	11.2
No Name	1,556	204	<1	14.3	47.2	17.3	75.6	19.1	19.0	15.5	47.0	17.3
North	2,031	118	1	6.3	8.4	6.7	44.4	8.5	15.0	7.0	15.0	7.0
North Big Salt Lake	20,299	4,210	69	21.6	681.8	25.0	796	25.6	414.9	23.7	518.0	24.2
North Kasaan Bay Frontage	14,707	4,033	<1	28.0	15.0	28.1	15.0	28.1	13.0	28.1	13.0	28.1
North Sal	688	53	<1	8.5	0.0	8.5	81.0	20.3	0.0	8.5	0.0	8.5
Pin	857	63	198	32.5	0.0	32.5	41.3	37.3	0.0	32.5	0.0	32.5
Ratz Harbor	828	34	<1	5.6	38.0	10.2	43.0	10.9	9.0	6.7	43.0	10.8
Rio Beaver Creek	9,050	594	155	8.8	204.9	11.1	324.0	12.4	200.0	11.1	260.4	11.7
Sal Creek	4,644	392	1	8.7	87.0	10.6	167.0	12.3	127.0	11.5	133.0	11.6
Salamander	1,289	70	30	8.6	0.0	8.6	61.0	13.4	0.0	8.6	0.0	8.6
Slide Creek	6,485	628	2	10.1	82.5	11.4	90.5	11.5	3.0	10.2	66.0	11.1
Snakey Lakes Lowlands	6,645	885	2	13.6	362.3	19.1	386.3	19.4	141.2	15.8	251.2	17.4
Thorne	2,509	101	168	11.0	0.0	11.0	184.7	18.3	0.0	11.0	0.0	11.0
Thorne Bay	6,358	1,151	186	21.3	3.0	21.4	23.0	21.7	23.0	21.7	23.0	21.7
Thorne Lake	16,110	387	5	2.6	0.0	2.6	176.9	3.7	0.0	2.6	0.0	2.6
Thorne River Intertidal	1,810	107	3	6.2	0.0	6.2	41.9	8.5	27.0	7.7	39.0	8.4
Tiny	529	27	<1	5.8	45.0	14.3	53.0	15.9	53.0	15.8	53.0	15.8
Torrent	1,807	149	3	10.0	86.2	14.8	86.2	14.8	58.2	13.2	75.2	14.2
West Fork Luck Creek	7,317	649	2	9.1	190.0	11.7	225.0	12.2	135.0	10.9	168.0	11.4
West Fork North Thorne River	8,382	464	3	5.6	164.1	7.6	202.1	8.1	76.0	6.5	69.0	6.5

1/ Existing harvest and roads area since 1981, including: harvested area and area in roads outside of harvest.
2/ Reasonably foreseeable harvest and roads area, including: foreseeable non-Project harvest related to the Roadside EA micro-sales and individual use free timber, the Control Lake EA, and future harvest on State lands. Area is rounded to the nearest acre. See Watershed Resource Report (James 2013) for detailed calculations.
3/ Includes existing harvest and roads and reasonably foreseeable harvest as percent basin area.
4/ Alternative-specific proposed harvest and roads area including: acres of proposed harvest and acres of proposed roads outside of harvest areas.
5/ Cumulative harvest and roads since 1981 includes including: harvest and roads since 1981, reasonably foreseeably harvest, and area of proposed harvest and roads.

Table WTR-10. Cumulative Percent Road Area by Big Thorne Project Alternatives

Subwatershed Names	Total Basin Size (Acres)	Existing and Foreseeable (Alternative 1)		Alternative 2	Alternative 3	Alternative 4	Alternative 5
		Total Road (Acres)1/	Percent of Basin as Roads2/,3/	Percent of Basin as Roads2/,3/	Percent of Basin as Roads2/,3/	Percent of Basin as Roads2/,3/	Percent of Basin as Roads2/,3/
Baird Peak	4,230	9.8	0.2	0.3	0.3	0.2	0.2
Barren	2,000	30.8	1.5	2.2	2.2	1.5	1.5
Big Ratz	10,299	140.4	1.4	1.4	1.4	1.4	1.4
Central Thorne River	6,986	96.7	1.4	1.6	1.6	1.4	1.5
Cobble Creek	2,137	37.1	1.7	1.8	1.9	1.7	1.8
Control Lake	18,624	110.2	0.6	0.6	0.6	0.6	0.6
Deer Creek	2,902	91.8	3.2	3.5	3.5	3.2	3.2
Doughnut	1,863	0.0	0.0	0.0	0.0	0.0	0.0
Eagle Creek/Slide Creek	4,556	60.8	1.3	1.3	1.3	1.3	1.3
East Fork North Thorne	7,548	69.2	0.9	0.9	0.9	0.9	0.9
Falls Creek	2,408	43.5	1.8	2.0	2.0	1.8	1.9
Goose Creek	13,502	171.0	1.3	1.4	1.4	1.3	1.3
Gravelly Creek	6,864	138.1	2.0	2.0	2.1	2.0	2.1
Lake Ellen	5,331	114.4	2.1	2.1	2.2	2.1	2.1
Little Ratz Creek	3,530	47.2	1.3	1.3	1.3	1.3	1.3
Luck Lake	7,499	124.5	1.7	1.7	1.8	1.7	1.7
Luck Point	1,410	16.4	1.2	1.2	1.3	1.2	1.2
No Name	1,556	27.4	1.8	1.9	1.9	1.8	1.8
North	2,031	31.7	1.6	1.6	1.6	1.6	1.6
North Big Salt Lake	20,299	286.2	1.4	1.5	1.5	1.4	1.4
North Kasaan Bay Frontage	14,707	272.8	1.9	1.9	1.9	1.9	1.9
North Sal	688	9.7	1.4	1.4	1.4	1.4	1.4
Pin	857	26.5	3.1	3.1	3.8	3.1	3.1
Ratz Harbor	828	21.8	2.6	3.0	3.0	2.6	2.6
Rio Beaver Creek	9,050	154.2	1.7	1.8	1.8	1.7	1.7
Sal Creek	4,644	67.8	1.5	1.5	1.5	1.5	1.5
Salamander	1,289	37.0	2.9	2.9	3.1	2.9	2.9
Slide Creek	6,485	179.9	2.8	2.8	2.8	2.8	2.8
Snakey Lakes Lowlands	6,645	69.5	1.0	1.2	1.2	1.1	1.1
Thorne	2,509	17.4	0.7	0.7	1.3	0.7	0.7
Thorne Bay	6,358	164.5	2.6	2.6	2.6	2.6	2.6
Thorne Lake	16,110	37.1	0.2	0.2	0.3	0.2	0.2
Thorne River Intertidal	1,810	45.8	2.5	2.5	2.6	2.5	2.5
Tiny	529	10.7	2.0	2.0	2.0	2.0	2.0
Torrent	1,807	81.5	4.5	4.7	4.7	4.5	4.5
West Fork Luck Creek	7,317	88.1	1.2	1.2	1.2	1.2	1.2
West Fork North Thorne	8,382	56.5	0.7	0.7	0.7	0.7	0.7

1/ Includes existing roads and foreseeable future roads associated with the Control Lake EIS (NEPA-approved unharvested units) and timber harvest on State lands.
2/ Percent of basin in roads was calculated by converting miles of road to acres of road using an estimated 40 feet wide road width and then calculating the percent of basin area in road acreage.
3/ Table includes all roads in available GIS coverage's [system (including roads in storage), temporary (including any decommissioned roads still available in the GIS layers), unauthorized, and non-National Forest roads].

Table WTR-11. Direct, Indirect, and Cumulative Effects by Big Thorne Project Alternatives in Affected Subwatersheds

	Alternative 2					Alternative 3					Alternative 4					Alternative 5				
	Streamflow		Sedimentation		Increases in Number of Crossings[1/]	Streamflow		Sedimentation		Increase in Number of Crossings[1/]	Streamflow		Sedimentation		Increase in Number of Crossings[1/]	Streamflow		Sedimentation		Increase in Number of Crossings[1/]
Subwatershed Name	Direct and Indirect	Cumulative	Direct and Indirect	Cumulative		Direct and Indirect	Cumulative	Direct and Indirect	Cumulative		Direct and Indirect	Cumulative	Direct and Indirect	Cumulative		Direct and Indirect	Cumulative	Direct and Indirect	Cumulative	
Baird Peak	minor	minor	minor	minor	no	minor	minor	minor	minor	no	none	none	none	none	no	minor	minor	minor	minor	no
Barren	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	none	none	no	minor	minor	none	none	no
Big Ratz	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Central Thorne River	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Cobble Creek	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Control Lake	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Deer Creek	minor	minor	moderate	moderate	yes	minor	minor	moderate	moderate	yes	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no
Doughnut	none	none	none	none	no	minor	minor	none	none	no	none	none	none	none	no	none	none	none	none	no
Eagle Creek/Slide Creek	minor	minor	none	none	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
East Fork North Thorne	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Falls Creek	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Goose Creek	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Gravelly Creek	minor	minor	minor	minor	no	minor	minor	minor	minor	yes	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Lake Ellen	none	none	none	none	no	none	minor	minor	minor	no	none	none	none	none	no	none	none	none	none	no
Little Ratz Creek	minor	minor	none	none	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	none	none	no
Luck Lake	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	yes	minor	minor	minor	minor	no
Luck Point	none	none	none	none	no	minor	minor	minor	minor	no	none	none	none	none	no	none	none	none	none	no
No Name	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	none	none	no	minor	minor	none	none	no
North	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
North Big Salt Lake	moderate	moderate	minor	minor	yes	moderate	moderate	minor	minor	yes	moderate	moderate	minor	minor	yes	moderate	moderate	minor	minor	yes
North Kasaan Bay Frontage	moderate	moderate	none	none	no	moderate	moderate	none	none	no	moderate	moderate	none	none	no	moderate	moderate	none	none	no
North Sal	none	none	none	none	no	moderate	moderate	minor	minor	no	none	none	none	none	no	none	none	none	none	no
Pin	none	none	none	none	no	minor	moderate	moderate	moderate	yes	none	none	none	none	no	none	none	none	none	no
Ratz Harbor	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	none	none	no
Rio Beaver Creek	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Sal Creek	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	none	none	no
Salamander	none	none	none	none	no	minor	minor	moderate	moderate	no	none	none	none	none	no	none	none	none	none	no
Slide Creek	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	none	none	no
Snakey Lakes Lowlands	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no
Thorne	none	none	none	none	no	minor	minor	minor	minor	yes	none	none	none	none	no	none	minor	none	none	no
Thorne Bay	minor	moderate	minor	moderate	no	minor	moderate	minor	moderate	no	minor	moderate	minor	moderate	no	minor	moderate	minor	moderate	no
Thorne Lake	none	none	none	none	no	minor	minor	minor	minor	yes	none	none	none	none	no	none	none	none	none	no
Thorne River Intertidal	none	none	none	none	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	moderate	moderate	no
Tiny	minor	minor	none	none	no	minor	minor	none	none	no	minor	minor	none	none	no	minor	minor	none	none	no
Torrent	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no	minor	minor	moderate	moderate	no
West Fork Luck Creek	minor	minor	none	none	no	minor	minor	none	none	no	minor	minor	none	none	no	minor	minor	none	none	no
West Fork North Thorne	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	minor	minor	no	minor	minor	none	none	no

1/ Indicates increase in number of Class I, II, III stream-crossings compared to the total number of Class I, II, III stream-crossings for existing roads.

Alternative 1 – No Action

Direct and Indirect Effects

Since no activities are proposed in this alternative, no direct or indirect effects would occur. Vegetation recovery would occur by 2015 in all watersheds and subwatersheds, except the Tolstoi Bay – Frontal Clarence Strait watershed and North Kasaan Bay Frontage subwatershed, as forested areas increase in maturity. No associated road maintenance would occur, therefore sediment sources and other road maintenance issues would not be improved. Natural soil disturbances would continue to occur; however, vegetation in previously harvested areas would grow, adding stability to the soil, and reduce the likelihood of landslides in watersheds and subwatersheds. Although the watersheds and subwatersheds within the Big Thorne project area are not undisturbed, streamflow and water quality would be maintained. However, there remains the risk of Power Lake Dam failure, which could affect downstream anadromous fish areas through increased sedimentation.

The USDA Forest Service nationally rated Slide Creek – Frontal Clarence Strait watershed will likely remain “functioning-at risk” due to high percentages of riparian areas in young growth and the current density of roads and proximity to waterbodies. The presence of fish barrier stream crossings and contaminated soils will also continue to result in a degraded watershed condition. Sediment sources and other road maintenance would be limited to those actions occurring due to standard road maintenance and restoration activities that are not associated with the Big Thorne Project. Riparian conditions would continue to improve with time as stands age, and riparian thinning would continue to occur in an effort to accelerate maturation of stand condition to more old-growth characteristics.

Cumulative Effects

Because there are no direct or indirect effects associated with the Big Thorne Project, there are no cumulative effects associated with Alternative 1. Effects of past activities are described in the Affected Environment. Effects of present and reasonably foreseeable activities would be as described in the previous sections.

Per Appendix A of the Watershed Resources Report (James 2013) and Table WTR-9, past harvest plus reasonably foreseeable harvest may result in streamflow increases (based on percent basin area harvested) in the North Big Salt Lake and Tolstoi Bay – Frontal Clarence Strait watersheds and North Big Salt Lake, North Kasaan Bay Frontage, Pin, and Thorne Bay subwatersheds. Increased streamflow within these watersheds and subwatersheds may be moderate, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat.

The State of Alaska and EPA reclamation and cleanup efforts to address the Category 5 Salt Chuck Bay impaired waterbody and Salt Chuck Mine site would continue. These efforts will likely cause a reduction in potential hazardous material runoff to streams, lakes, and the Salt Chuck Bay near the mine site. The Forest Service monitoring of the Category 4a Thorne Bay Landfill would continue within South Creek. Continued monitoring will likely help determine if hazardous material from the landfill persists in South Creek.

It is estimated that 253.8 miles of existing road, likely constructed from the Descon Shale, exists within the Big Thorne project area. It is not known if the material sources used in this construction contained mineralization. However, no past problems have been observed (Baichtal personal comm. 2011, as cited in Barnhart and Hitner 2013b). Present or reasonably foreseeable actions or new construction on these roads or use of quarries from this rock formation would be tested for sources with high potential and be avoided. If ARD potential rock is disturbed, mitigation would include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Per Appendix B of the Watershed Resource Report (James 2013), when past, present, and reasonably foreseeable road construction is combined, the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Pin, Ratz Harbor, Salamander, Slide Creek, Thorne Bay, Thorne River Intertidal, and Torrent subwatersheds exceed the 2.5 percent basin area in roads threshold and may result in moderate (though difficult to measure) impacts from increases in sediment.

Conclusion

Alternative 1 (No Action) has no direct, indirect, or cumulative effects on watersheds or subwatersheds as a result of the Big Thorne Project. Harvest and road construction in the Big Thorne project area would be less than in the action alternatives.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Alternative 2 would result in minor effects on sedimentation and aquatic habitat, with moderate effects in some watersheds and subwatersheds. Alternative 2 would further increase the percent basin area harvested since 1981 in the North Big Salt Lake watershed and North Big Salt Lake and North Kasaan Bay Frontage subwatersheds above the 20 percent threshold (Table WTR-6). Streamflow may increase in these watersheds and subwatersheds, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat. Alternative 2 would not increase any other watershed or subwatershed percent basin harvested over the 20 percent in 30 years threshold.

Alternative 2 is not expected to result in any direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the USDA Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, USDA Forest Service Salt Chuck Mine, and USDA Forest Service Thorne Bay Landfill contaminated sites. Riparian no-harvest and RAW buffers as needed along Class I, II, and III streams, as described in the unit cards, and BMPs, as described in the road cards, would limit impacts from the planned activities on these water supplies, waterbodies, and contaminated sites.

Road construction and quarry development for the Big Thorne Project activities would utilize and excavate into the underlying Descon Shale. Any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 2 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the Forest Service geologist would provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials would be tested and sources with high potential would be avoided. If ARD potential rock is disturbed, mitigation would include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Alternative 2 would construct 32.1 miles of road (includes proposed new roads and new construction over decommissioned road grades) that would have 9 Class I and II (9 Class III) road-stream crossings and reconstruct 18.1 miles of road that have 43 Class I and II (8 Class III) road-stream crossings. This would result in minor to moderate effects on sedimentation and aquatic habitat in all watersheds and subwatersheds. Moderate (though difficult to measure) effects on sedimentation and aquatic habitat may occur in the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Ratz Harbor, Slide Creek, and Torrent subwatersheds, as they exceed the 2.5 percent basin area in roads threshold (Table WTR-7). Compared to other action alternatives, Alternative 2 would have the second-highest level of effects on sedimentation and aquatic habitat.

Alternative 2 would have minor effects on the USDA Forest Service nationally rated "functioning-at risk" Slide Creek – Frontal Clarence Strait watershed. The watershed will likely remain "functioning-at risk" due to high percentages of riparian areas being in young growth and the current density of roads and proximity to waterbodies. Harvest and road construction under Alternative 2 would not result in greater than 20 percent of the basin area harvested since 1981 or increase road density above the 2.5 percent basin area in roads threshold for this watershed. Implementation of riparian no-harvest and RAW buffers as needed along Class I, II, and III streams, as described in the unit cards, BMPs, as described in the road cards, and decommissioning all temporary project roads would minimize direct and indirect effects on the Slide Creek – Frontal Clarence Strait watershed. However, while all new road construction will follow BMPs and Forest Plan Standards and Guidelines, there may be increased risk of sedimentation due to the presence of the road prism within the watershed.

Cumulative Effects

Watershed and subwatershed effects from past practices are described in the Affected Environment. Because present and reasonably foreseeable activities are consistently evaluated across all alternatives, Alternative 2 ranks second in cumulative effects on sedimentation and aquatic habitat in all watersheds and subwatersheds.

Per Appendix A of the Watershed Resources Report (James 2013) and Table WTR-9, additional harvest of NEPA-cleared units and state lands combined with harvest under Alternative 2 may result in further streamflow increases (based on percent basin area harvested) in the North Big Salt Lake watershed and North Big Salt Lake, North Kasaan Bay Frontage, and Thorne Bay subwatersheds. Increased streamflow within these watersheds and subwatersheds may be moderate, but the changes are not expected to result in measurable impacts on sedimentation or aquatic habitat.

Because there are no direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the USDA Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, USDA Forest

Service Salt Chuck Mine, and USDA Forest Service Thorne Bay Landfill contaminated sites, there are no cumulative effects.

During road construction, any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 2 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist would provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials would be tested and sources with high potential would be avoided. If ARD potential rock is disturbed, mitigation would include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Per Appendix B of the Watershed Resources Report (James 2013) and Table WTR-10, when past and reasonably foreseeable road construction is combined with road construction under Alternative 2, the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Ratz Harbor, Slide Creek, Thorne Bay, and Torrent subwatersheds further exceed the 2.5 percent basin area in roads threshold and may result in moderate (though difficult to measure) impacts.

Conclusion

Alternative 2 would result in no effect, minor effects, or moderate effects relative to sedimentation and aquatic habitat, depending on the subwatershed. In general, effects would be localized, at the site or stream-reach level. Compared to Alternative 3, Alternative 2 would have less effect on sedimentation and aquatic habitat. Compared to Alternatives 4 and 5, Alternative 2 would have more new road construction and road-stream crossings (Class I, II, and III), resulting in greater effects on sedimentation and aquatic habitat than Alternatives 4 and 5.

Alternative 3

Direct and Indirect Effects

Alternative 3 would result in minor effects on sedimentation and aquatic habitat, with moderate effects in some watersheds and subwatersheds. Alternative 3 would further increase the percent basin area harvested since 1981 in the North Big Salt Lake and Tolstoi Bay – Frontal Clarence Strait watersheds and North Big Salt Lake, North Kasaan Bay Frontage, and North Sal subwatersheds above the 20 percent threshold (Table WTR-6). Streamflow may increase in these watersheds and subwatersheds, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat. Alternative 3 would not increase any other watershed or subwatershed percent basin harvested over the 20 percent in 30 years threshold.

Alternative 3 is not expected to result in any direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites. Riparian no-harvest and RAW buffers as needed along Class I, II, and

III streams, as described in the unit cards, and BMPs, as described in the road cards, would limit impacts from the planned activities on these water supplies, waterbodies, and contaminated sites.

Road construction and quarry development for the Big Thorne Project activities would utilize and excavate into the underlying Descon Shale. Any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 3 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the Forest Service geologist would provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials would be tested and sources with high potential would be avoided. If ARD potential rock is disturbed, mitigation would include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Alternative 3 would construct 51.8 miles of road (includes proposed new roads and new construction over decommissioned road grades) that would have 23 Class I and II (16 Class III) road-stream crossings and reconstruct 37.5 miles of road that have 97 Class I and II (28 Class III) road-stream crossings. This would result in minor to moderate effects on sedimentation and aquatic habitat in all watersheds and subwatersheds. Moderate (though difficult to measure) effects on sedimentation and aquatic habitat may occur in the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Pin, Ratz Harbor, Salamander, Slide Creek, Thorne River Intertidal, and Torrent subwatersheds, as they exceed the 2.5 percent basin area in roads threshold (Table WTR-7). Compared to other action alternatives, Alternative 3 would have the most effects on sedimentation and aquatic habitat.

Alternative 3 would have minor effects on the Forest Service nationally rated "functioning-at risk" Slide Creek – Frontal Clarence Strait watershed. The watershed will likely remain "functioning-at risk" due to high percentages of riparian areas being in young growth and the current density of roads and proximity to waterbodies. Harvest and road construction under Alternative 3 would not result in greater than 20 percent of the basin area harvested since 1981 or increase road density above the 2.5 percent basin area in roads threshold for this watershed. Implementation of riparian no-harvest and RAW buffers as needed along Class I, II, and III streams, as described in the unit cards, BMPs, as described in the road cards, and decommissioning all temporary project roads would minimize direct and indirect effects on the Slide Creek – Frontal Clarence Strait watershed. However, while all new road construction will follow BMPs and Forest Plan Standards and Guidelines, there may be increased risk of sedimentation due to the presence of the road prism within the watershed.

Cumulative Effects

Watershed and subwatershed effects from past practices are described in the Affected Environment. Because present and reasonably foreseeable activities are consistently evaluated across all alternatives, Alternative 3 would result in the highest level of cumulative effects on sedimentation and aquatic habitat in all watersheds and subwatersheds.

Per Appendix A of the Watershed Resources Report (James 2013) and Table WTR-9, additional harvest of NEPA-cleared units and state lands combined with harvest under Alternative 3 will likely result in further streamflow increases (based on percent basin area harvested) in the North Big Salt Lake and Tolstoi Bay – Frontal Clarence Strait watersheds and Deer Creek, Luck Lake, North Big Salt Lake, North Kasaan Bay Frontage, North Sal, Pin, and Thorne Bay subwatersheds. Increased streamflow within these watersheds and subwatersheds may be moderate, but the changes are not expected to result in measurable impacts on sedimentation or aquatic habitat.

Because there are no direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites, there are no cumulative effects.

During road construction, any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 3 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist would provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials would be tested and sources with high potential would be avoided. If ARD potential rock is disturbed, mitigation would include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Per Appendix B of the Watershed Resources Report (James 2013) and Table WTR-10, when past and reasonably foreseeable road construction is combined with road construction under Alternative 3, the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Pin, Ratz Harbor, Salamander, Slide Creek, Thorne Bay, Thorne River Intertidal, and Torrent subwatersheds further exceed the 2.5 percent basin area in roads threshold and may result in moderate (though difficult to measure) impacts.

Conclusion

Alternative 3 would result in no effect, minor effects, or moderate effects relative to sedimentation and aquatic habitat, depending on the subwatershed. In general, effects would be localized, at the site or stream-reach level. Compared to other alternatives, Alternative 3 has the largest effects relative to sedimentation and aquatic habitat.

Alternative 4

Direct and Indirect Effects

Alternative 4 would result in minor effects on sedimentation and aquatic habitat, with moderate effects in some watersheds and subwatersheds. Alternative 4 would further increase the percent basin area harvested since 1981 in the North Big Salt Lake watershed and North Big Salt Lake and North Kasaan Bay Frontage subwatersheds above the 20 percent threshold (Table WTR-6). Streamflow may increase in these watershed and subwatersheds, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat. Alternative 4 would not increase any other watershed or subwatershed percent basin harvested over the 20 percent in 30 years threshold.

Alternative 4 is not expected to result in any direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites. Riparian no-harvest and RAW buffers as needed along Class I, II, and III streams, as described in the unit cards, and BMPs, as described in the road cards, would limit impacts from the planned activities on these water supplies, waterbodies, and contaminated sites.

Road construction and quarry development for the Big Thorne Project activities would utilize and excavate into the underlying Descon Shale. Any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 4 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist would provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials would be tested and sources with high potential would be avoided. If ARD potential rock is disturbed, mitigation would include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Alternative 4 would construct 11.3 miles of road (includes proposed new roads and new construction over decommissioned road grades) that would have 5 Class I and II (3 Class III) road-stream crossings and reconstruct 20.2 miles of road that have 53 Class I and II (7 Class III) road-stream crossings. This would result in minor to moderate effects on sedimentation and aquatic habitat in all watersheds and subwatersheds. Moderate (though difficult to measure) effects on sedimentation and aquatic habitat may occur in the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Ratz Harbor, Slide Creek, and Torrent subwatersheds, as they exceed the 2.5 percent basin area in roads threshold (Table WTR-7). Compared to other action alternatives, Alternative 4 would have effects similar to Alternative 5 on sedimentation and aquatic habitat.

Alternative 4 would have minor effects on the Forest Service nationally rated “functioning-at risk” Slide Creek – Frontal Clarence Strait watershed. The watershed will likely remain “functioning-at risk” due to high percentages of riparian areas being in young growth and the current density of roads and proximity to waterbodies. Harvest and road construction under Alternative 4 would not result in greater than 20 percent of the basin area harvested since 1981 or increase road density above the 2.5 percent basin area in roads threshold for this watershed. Implementation of riparian no-harvest and RAW buffers as needed along Class I, II, and III streams, as described in the unit cards, BMPs, as described in the road cards, and decommissioning all temporary project roads would minimize direct and indirect effects on the Slide Creek – Frontal Clarence Strait watershed. However, while all new road construction will follow BMPs and Forest Plan

Standards and Guidelines, there may be increased risk of sedimentation due to the presence of the road prism within the watershed.

Cumulative Effects

Watershed and subwatershed effects from past practices are described in the Affected Environment. Because present and reasonably foreseeable activities are consistently evaluated across all alternatives, Alternative 4 would have the least effect on sedimentation and aquatic habitat in all watersheds and subwatersheds.

Per Appendix A of the Watershed Resources Report (James 2013) and Table WTR-9, additional harvest of NEPA-cleared units and state lands combined with harvest under Alternative 4 will likely result in further streamflow increases (based on percent basin area harvested) in the North Big Salt Lake watershed and the North Big Salt Lake, North Kasaan Bay Frontage, and Thorne Bay subwatersheds. Increased streamflow within these watersheds and subwatersheds may be moderate, but the changes are not expected to result in measurable impacts on sedimentation or aquatic habitat.

Because there are no direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites, there are no cumulative effects.

During road construction, any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 4 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the USDA Forest Service geologist would provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials would be tested and sources with high potential would be avoided. If ARD potential rock is disturbed, mitigation would include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Per Appendix B of the Watershed Resources Report (James 2013) and Table WTR-10, when past and reasonably foreseeable road construction is combined with road construction under Alternative 4, the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, Ratz Harbor, Slide Creek, Thorne Bay, Thorne River Intertidal, and Torrent subwatersheds further exceed the 2.5 percent basin area in roads threshold and may result in moderate (though difficult to measure) impacts.

Conclusion

Alternative 4 would result in no effect, minor effects, or moderate effects on sedimentation and aquatic habitat, depending on the subwatershed. In general, effects would be localized, at the site or stream-reach level. Compared to Alternatives 2 and 3, Alternative 4 would have less effect on sedimentation and aquatic habitat. Compared to

Alternative 5, Alternative 4 would have less harvest, less new road construction, more reconstruction of ML1 stored roads, and more road-stream crossings (Class I, II, and III), resulting in similar, but slightly less, effect on sedimentation and aquatic habitat than Alternative 5.

Alternative 5

Alternative 5 was developed to specifically respond to Issue 4, by reducing the effects on sedimentation and aquatic habitat beyond what is required under the Forest Plan while maintaining an economically viable timber sale that would meet the purpose and need of the project. This alternative would construct slightly more road miles than Alternative 4, but substantially less road miles than Alternatives 2 or 3, and have the fewest road-stream crossings (Class I, II, and III) of all the alternatives. In addition, specific units were removed, while other units were changed to helicopter in areas where there were concerns from past harvest and/or high percentage of the basin in roads.

Direct and Indirect Effects

Alternative 5 would result in minor effects on sedimentation and aquatic habitat, with moderate effects in some watersheds and subwatersheds. Alternative 5 would further increase the percent basin area harvested since 1981 in the North Big Salt Lake watershed and North Big Salt Lake and North Kasaan Bay Frontage subwatersheds above the 20 percent threshold (Table WTR-6). Streamflow may increase in these watershed and subwatersheds, but the changes are not expected to result in measurable effects on sedimentation or aquatic habitat. Alternative 5 would not increase any other watershed or subwatershed percent basin harvested over the 20 percent in 30 years threshold.

Alternative 5 is not expected to result in any direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites. Riparian no-harvest and RAW buffers as needed along Class I, II, and III streams, as described in the unit cards, and BMPs, as described in the road cards, would limit impacts from the planned activities on these water supplies, waterbodies, and contaminated sites.

Road construction and quarry development for the Big Thorne Project activities would utilize and excavate into the underlying Descon Shale. Any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 5 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the Forest Service geologist would provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials would be tested and sources with high potential would be avoided. If ARD potential rock is disturbed, mitigation would include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Alternative 5 would construct 15.3 miles of road (includes proposed new roads and new construction over decommissioned road grades) that would have 3 Class I and II (2 Class

III) road-stream crossings and reconstruct 16.5 miles of road that have 29 Class I and II (8 Class III) road-stream crossings. This would result in minor to moderate effects on sedimentation and aquatic habitat in all watersheds and subwatersheds. Moderate (though difficult to measure) effects on sedimentation and aquatic habitat may occur in the Thorne Bay – Frontal Tolstoi Bay watershed and Deer Creek, , and Torrent subwatersheds, as they exceed the 2.5 percent basin area in roads threshold (Table WTR-7). Compared to other action alternatives, Alternative 5 would be similar to Alternative 4 and have the second least effects on sedimentation and aquatic habitat.

Alternative 5 would have minor effects on the Forest Service nationally rated "functioning-at risk" Slide Creek – Frontal Clarence Strait watershed. The watershed will likely remain "functioning-at risk" due to high percentages of riparian areas being in young growth and the current density of roads and proximity to waterbodies. Harvest and road construction under Alternative 5 would not result in greater than 20 percent of the basin area harvested since 1981 or increase road density above the 2.5 percent basin area in roads threshold for this watershed. Implementation of riparian no-harvest and RAW buffers as needed along Class I, II, and III streams, as described in the unit cards, BMPs, as described in the road cards, and decommissioning all temporary project roads would minimize direct and indirect effects on the Slide Creek – Frontal Clarence Strait watershed. However, while all new road construction will follow BMPs and Forest Plan Standards and Guidelines, there may be increased risk of sedimentation due to the presence of the road prism within the watershed.

Cumulative Effects

Watershed and subwatershed effects from past practices are described in the Affected Environment. Because present and reasonably foreseeable activities are consistently evaluated across all alternatives, Alternative 5 would result in the least cumulative effects on sedimentation and aquatic habitat in all watersheds and subwatersheds.

Per Appendix A of the Watershed Resources Report (James 2013) and Table WTR-9, additional harvest of NEPA-cleared units and state lands combined with harvest under Alternative 5 will likely result in further streamflow increases (based on percent basin area harvested) in the North Big Salt Lake watershed and the North Big Salt Lake, North Kasaan Bay Frontage, and Thorne Bay subwatersheds. Increased streamflow within these watersheds and subwatersheds may be moderate, but the changes are not expected to result in measurable impacts on sedimentation or aquatic habitat.

Because there are no direct or indirect effects to the two PWS, Category 4a Thorne Bay impaired waterbody, Category 5 Salt Chuck Bay impaired waterbody, or the Forest Service Thorne Bay Warehouse Historic Spills, Thorne Bay DuRette Shop, Forest Service Salt Chuck Mine, and Forest Service Thorne Bay Landfill contaminated sites, there are no cumulative effects.

During road construction, any existing material source or newly developed source within the Descon Formation used to construct access to the proposed harvest areas under Alternative 5 would be assessed for its ARD potential. In areas where full-bench construction is anticipated and the underlying bedrock (containing pyrite) may be mineralized, the Forest Service geologist would provide on-site inspection during excavation and construction to identify potential mineralized zones. Quarry materials would be tested and sources with high potential would be avoided. If ARD potential rock is disturbed, mitigation would include lining the upslope ditch with limestone aggregate to neutralize run-off from potential mineralized zones exposed during full bench construction.

Per Appendix B of the Watershed Resources Report (James 2013) and Table WTR-10, when past and reasonably foreseeable road construction is combined with road construction under Alternative 5, the Thorne Bay – Frontal Tolstoi Bay watershed and the Deer Creek, Thorne Bay, and Torrent subwatersheds would exceed the 2.5 percent basin area in roads threshold and may result in moderate (though difficult to measure) impacts.

Conclusion

Alternative 5 would result in no effect, minor effects, or moderate effects relative to sedimentation and aquatic habitat, depending on the subwatershed. In general, effects would be localized, at the site or stream-reach level. Compared to Alternatives 2 and 3, Alternative 5 would have less effect on sedimentation and aquatic habitat. Compared to Alternative 4, Alternative 5 would have more harvest, more new road construction, less reconstruction of ML1 stored roads, and less road-stream crossings (Class I, II, and III), resulting in similar, but slightly greater, effect on sedimentation and aquatic habitat than Alternative 4.